INTER-UNIVER

Monograph On Practical Examinations For Universities

V. NATARAJAN

RESEARCH CELL
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FOREWORD

Except for a few, most of the universities/institutions in the country, are still persisting with traditional outmoded and irrational methods of Practical/Laboratory/Field work examinations in different courses. No systematic thinking has gone into issues related to improvement of Practical/Laboratory/Field work in respect of defining objectives & scope and nature of work to be undertaken, formulating valid and reliable methods of measurement of achievement of these objectives, recording, reporting and using these to improve teaching and learning in Laboratories and field.

Prof.Natarajan, in this illuminative research project, has attempted to get a large number of teachers teaching different subject areas in universities, to respond to a series of issues related to scope and nature, objectives, assessment methods, and external examination, a system of continuous internal assessment, marking, grading, recording and reporting of Practical/Laboratory/Field work in the form of a well designed questionnaire using a 5 point scale response pattern.

It is to be said here that the problem relating to improvement of Practical/Laboratory/Field work assessment of student performance, is an open ended problem and each university has to look at it with the help of a large number of teachers in that university and come up with alternatives and finally arrive at an alternative that will work with them in their situations. It is not proposed to offer a ready-made solution to all universities.

However, responses from teachers from one university have been analysed to show how a design can be done and a modus operandi of a system of assessment of Practical/Laboratory/Field work arrived at. It is felt that Universities/institutions wishing to design improved and scientific methods of assessment of Practical/Laboratory/Field work, must do so using the questionnaire and their own teachers to respond to it.

It is also hoped to periodically solicit the views to the questionnaire to obtain more illumination in the light of experience. It must be said that the MSS of this monograph when shown to a few teachers from some universities, received their appreciation. It is felt that the teaching community will welcome this monograph and find it useful.

Pilani
6th March 1979

Dr. C. R. Mitra
President

PREFACE

Eventhough Practical/Laboratory/Field work carried out by students either individually or more commonly in small groups in various colleges and universities in the country in the field of higher education is an important constituent of Teaching/Learning in many disciplines, yet not much of thought has been given to define clearly the scope and nature of it; to specify objectives of it; to formulate assessment methods for it; to finally decide on the modes and grading of students' performances. It is true that many universities in the past have evolved a system of assessment of Practical/Laboratory/Field work based on mostly traditions and not very much on scientific principles. Years ago, the author participated in a heated debate on Practical Examinations at the Mysore University and this has prompted this research project to be undertaken.

In this illuminative Research Project consisting of 5 different stages of work, the first stage was concerned with a survey of universities adopting Practical/Laboratory/Field work examinations. Nearly 37 universities responded and gave details of their present practices and this forms part of Section 2 of this Monograph. Stage Two was primarily concerned with the development of a questionnaire (the research tool) to solicit views of teachers from different universities on issues like scope and nature, objectives, Assessment methods, design of procedures of assessment, marking vs grading and finally end exam. vs continuous internal assessment in regard to Practical/Laboratory/Field work in many disciplines. A sample population of 80 odd teachers' views at any one centre/ university, has been included for analysis more to indicate the lines on which other universities intending to produce scientific and rational assessment of Practical / Laboratory / Field work can proceed. Section III of the Monograph concerns with the consensus consolidated thinking of teachers in respect of aims and objectives of Practical/Laboratory/Field work. Section IV shows the procedures of consolidating the responses of teachers and indicates the design procedures and principles. The actual design emerges out in the process and some illustrative examples are included in the Appendix. The section on 'conclusions' brings to focus the details of a sound system of Practical/Laboratory/Field work assessment.

Section V of the Monograph is principally intended to identify the need of continuous internal assessment of Practical/Laboratory/Field work and the end examination as well. The methodology of conducting continuous internal assessment of Practical/Laboratory/Field work is presented based on the consensus of views of teachers. Section VI argues the case of introducing a grading system in place of marking and develops procedures for grading continuous internal assessment in Practical/Laboratory/Field work. Appendices contain the questionnaire, sample test materials for teachers who are keen to make use of the thinking here.

It is hoped to periodically solicit the views to the questionnaire from teachers and therefore it is likely to throw more illumination in respect of Practical/Laboratory/Field work assessment. It is felt that the teaching community will welcome this monograph and find it useful. Constructive criticisms and suggestions are most welcome from teachers, examiners and others.

New Delhi.
18th Jan. 1979

V. Natarajan
Author

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It is not possible to acknowledge hundreds of teachers who participated actively with their responses to the questionnaire to to make it more scientific.

INTRODUCTION

One of the most interesting features of teaching-learning in higher education in our country has been the tradition of Practical/ Laboratory/Field work carried out by students either invdividually or more commonly in small groups, this characteristic has been particularly evident in respect of the teaching of science subjects. Practical/Laboratory /Field work constitutes an important element in the teaching-learning process and the development of Practical/Laboratory skills has been established as an important desirable outcome of courses in many subjects. While Practical/Laboratory work is inherent in many science and professional courses (engineering, technology and medicine) field work is an important component of social and human sciences.

It is important to appreciate that the purpose of Practical/ Laboratory/Field work varies from subject to subject and that there can be a variety of purposes within an individual subject. For instance some Practical/Laboratory work will be carried out in a teaching course with the purpose of introducing, developing or reinforcing theoretical concepts; such work might be regarded as being of importance in the teaching - learning process but as being relatively unimportant in terms of the skills whose development is a major objective of the course. Practical/Laboratory work in the form of personal studies or 'projects' (individual or group) and certainly examples of work found in 'learning by discovery' situations all fall into this category. Their inclusion in any course of study can provide opportunities to develop student understanding of the particular aspects of the subject and demonstrating those practical skills necessary to undertake the work. Some subjects are often described as being 'Practical subjects' like art, craft subjects like needlework, dressmaking, cookery, woodwork, metal work etc. This means that one of the major educational objectives of the course is the acquisition and development of certain practical skills. It may also mean that some subjects are practical or laboratory based (Physics, Chemistry, Biology, Electronics etc.) In all these cases, Practical/Laboratory work is of importance in establishing and illustrating the theoretical aspects of the subject as well as developing necessary and desirable skills which all students of the subject should possess. If Practical/Laboratory/Field work is to be assessed, then the assessment should be concerned with measuring those skills and abilities which are not only important but also those that are developed in students. Before attempting to assess Practical/ Laboratory/Field work, we have to satisfactorily identify what is to be measured.

Practical/Laboratory/Field work is often regarded as being the 'DOING' activities rather than the 'KNOWING' qualities of students, but it is not as simple as this. It is as varied as are those purposes of practical work. Much Practical/Laboratory/Field work must involve the application of knowledge, the use of theoretical concepts and more open ended practical investigations rather than routine practical operations. The interrelationship in any subject between theory and practice must be studied and taken into account in assessment procedures. In fact, much of the work relating to examination reforms in Higher Education had so far been confined to improvement of questions for written tests and practical work and practical questions have attracted far less attention. Bloom, Ebel, Scriven, Gagne and others in the field of educational measurement greatly influenced the design of written examinations: such work in the area of objectives of Practical/ Laboratory/Field work is appearing here and there only.

The specification of objectives of assessment is the most crucial aspect in designing assessment procedures for Practical/ Laboratory/Field work. The question of deciding schemes of internal and external assessments in a subject is only a matter of matching the objectives; their mode of development and the feasibility of checking or measuring the attainment of them. While there are a good number of sources of objectives of Practical/ Laboratory/Field work, those that are produced by the Leicester School of Education can be quoted here as very useful.

1. Ability to use simple apparatus and implement simple procedures.

2. Ability to observe changes/differences in structures of systems under investigation and to record such changes/differences -ways which yield maximum relevant information.

3. Ability to select appropriate apparatus and/or procedures for a new experimental problem.

1.10. Knowledge of instruments/apparatus

1.20. Knowledge of procedures

1.30 Knowledge of ways of using instruments/apparatus

1.40 Knowledge of limitations of instruments/apparatus

2.10. Ability to use apparatus/instruments

2.20 Ability to implement procedures

2.30 Ability to select appropriate procedures/methods for a particular problem.

3.10 Ability to observe the structures or systems under investigation.

3.20 Ability to observe changes/differences in the dimensions of the structures or systems under investigation.

3.30 Ability to record appropriately the observed structure or system and the changes occuring in it.

3.40 Ability to handle data of tests/field work and interpret them.

4.0 Ability to write a report or communicate results in an acceptable form.

5.0 Ability to draw conclusions.

6.1 Ability to devise new apparatus to meet the demands of a practical problem.

6.2 Ability to devise novel procedures to solve a practical problem.

Generally speaking Practical/Laboratory/Field work of one kind or the other in various subjects, involves among other things, the following five major areas.

I. Skill in observations and recording of observations. These include practical/experimental/field data

II. Ability to interpret and assess the results of practical/laboratory/field data.

III. Ability to plan practical procedures and techniques for solving particular problems.

IV. Manipulative skills

V. Attitudes to Practical/Laboratory/Field work including such attributes as persistence, enthusiasm, originality and enjoyment.

The success of any scheme of assessment depends upon the quality of the instruments of assessments that are used. The stated objectives must be validly and reliably measured, the assessment procedure should not make unreasonable demand upon the available resources such as administration, manpower, finance, time etc., and finally the nature of assessment should not distort the educational process.

I. Skill in observation and the recording of observations:

Here the purpose of assessment is to measure the extent to which, in any given situation, the student observes those things that should be observed and makes appropriate recordings in order that he can subsequently evaluate the results of these observations. These may be for 'verification' type as well as 'investigation' type of experiments or practical work. Students can be presented with specific operation either as demonstrations or as exercises to carry out for themselves and be required to make records of these. Both oral reporting as well as written reporting are possible. Sometimes all that is there in an observation is to be given while very many times the student's ability to identify important and relevant features will be involved. This major objective can be a component of continuous internal evaluation and also form part of external, end examination.

II. Ability to interpret and assess the results of Practical/Laboratory/Field Work Data.

Here the purpose of assessment is to measure the extent to which the student can evaluate the results obtained by Practical/ Laboratory/Field work. The student may have to carry out calculations, identify unknowns to determine particular characteristics of material under investigation, draw graphs, charts and perhaps make meaningful interpretations. Drawing conclusions or providing an explanation is definitely involved. The correctness of this of course will depend upon the accuracy with which observations are made. The question of combining the correctness of observations and the consequent correctness of interpretations may be quite relevant in continuous internal evaluation and therefore an end, external examination will find it difficult to do both at the same time.

III Ability to plan practical procedures and techniques for solving particular problems

The purpose of assessment is to measure the extent to which the student is able to plan a procedure for Practical/Laboratory/ Field work. A practical problem within the competence of students may have to be presented and the student will be required to evolve an appropriate method of solving it. A new situation requiring basic procedures known to the students, yet involving the student to choose appropriately is what is intended. Routine 'verification' type of experiments/exercises in laboratory will fail to develop the ability as well prove to be inadequate for testing this ability. Investigation type of experiments requiring students so to say to do on their own experiments/exercises will certainly help the students to develop this ability and hence test these abilities. Continuous internal evaluation is much more meaningful for this objective than an end practical/laboratory examination.

IV Manipulative skills

The purpose of the assessment is to measure the extent to which the student can carry out the range of manipulative skills intended to be developed. Practical/Laboratory examinations mostly assume that manipulative skills are being measured by exercises/experiments in which the student is required to perform specified operations and report results. There is a danger, however, that the student's mastery of specific skills may be hidden in the overall result obtained. Manipulative skills are always best assessed in situations in which the specific skill can be isolated for attention. Continuous internal assessment where the assessor can actually observe the student's actions and assess, is much more meaningful than an external examination involving a good number of students at a time.

V Attitudes towards practical work

Here one is concerned with such things as the student's approach-the extent to which he accepts the practical approach, the scientific and positive attitude to report observations as such without cooking up etc. Attitude measuring scales are to be constructed and grading on a 5-point scale can be done. Here continuous internal assessment by the teacher making use of an attitudinal scale is much more meaningful and valid. The scale may be of the following type.

S. No.	Description	5	4	3	2	1
1.	Admires good students, teachers					
2.	Is ready to undertake practical work?					
3.	Is ready to undertake tests?					
4.	Examines every detail in the Practical/Laboratory problem					
5.	Seeks fresh clues beyond the ones known					
6.	Reports observations without working up (cooking)					
7.	Accepts mistakes without reservations.					
8.	Is ready to experiment again					
9.	Sticks to the practical/laboratory/field problem and never leaves it unsolved					

10. Takes pleasure in doing practical/laboratory/field work					

The various methodologies include set exercises, project work, course work, oral questioning and assessment by impression. In Practical/Laboratory/Field work, general approach, technique, accuracy, interpretation and conclusion and report are all involved and they form heads of assessment. Either 25 marks per experiment/laboratory exercise/field work can be allotted with - General Approach (4), Technique (4), Accuracy (5), Interpretation (6) and conclusion and Report (6) or these can be graded using a 7-point scale. It is felt that traditional laboratory sheets, practical work instruction sheets giving aim, procedure, results, conclusion and reports based on this tend to encourage copying from only one student who performs the work in the laboratory/field. In its place, increasing use of laboratory sheet involving questions/answers on an individual basis or programmed instruction material for handling instruments/performing experiments must be made to really make laboratories a learning place. It is also felt that laboratory work/practical work/field work, in order to develop the kind of skills/abilities desired, must be made up of "verification" as well as "investigation" types of exercises/experiments. This really means that certain experiments can be performed by students in an "investigation" type without even knowing the theory behind. These investigation experiments are so carefully planned that students will be led to discover, as it were, certain things which are not till then taught to them. In addition, there is another value in it; this kind of investigation develops certain abilities/skills of experimentation, innovation, discovery that there is overall satisfaction leading to better motivation on the part of students.

The main purpose of this monograph is to provide a rational & scientific design for the practical/laboratory/field work examinations and also to assess its current practice. For this a fairly exhaustive questionnaire dealing with all the academic and non-academic aspects of the practical examinations was prepared and administered to various university/college teachers. Since it was somewhat difficult to analyse all the questionnaires received from the teachers of the various disciplines, a sample of 81 questionnaires was selected and analysed. The consensus of the teachers' responses to the various items are summarised and given in the fourth chapter of this monograph.

SECTION II

DEVELOPMENT SO FAR

DEVELOPMENT SO FAR

Information in regard to Practical Examinations for Various Courses in Universities.

A brief description of the information regarding the practical examinations, received from different Universities, is given as follows:

1. University of Allahabad:

Following are the departments in which practical examinations are held:

1) Faculty of Arts:
   - a. Deptt. of Psychology
   - b. Deptt. of Geography
   - c. Deptt. of Music.

2) Faculty of Science:
   - a. Deptt. of Botany
   - b. Deptt. of Zoology
   - c. Deptt. of Chemistry
   - d. Deptt. of Defense Studies
   - e. Deptt. of Electronics & Tele-Communication.
   - f. Deptt. of Bio-Chemistry
   - g. Deptt. of Physics
   - h. Deptt. of Mathematics.

A detailed description of the practical examinations in all these Departments can be had in the following table:

Name of the Examination	Total Number of marks		Duration of examination	Mode of Assessment	
	External	Internal		External	Internal
Department of					

Psychology					
B.A. Part I	50	-	4 hours	yes	yes
B.A. Part II	50	-	4 hours	yes	yes
M.A. Prev.	100	-	5 hours	yes	yes
M.A. Final	100	-	5 hours	yes	yes
Department of Geography					
B.A. Part I	50	-	3 hours	yes	yes
B.A. Part II	50	-	2 hours	yes	yes
M.A. Prev.	100	-	6 hours	yes	yes
M.A. Final	100	-	6 hours	yes	yes
Department of Defence Studies					
B.A. Part I	50	-	$\frac{1}{2}$ hour	-	-
B.A. Part II	50	-	$\frac{1}{2}$ hour	-	-
M.A. Prev. & Final	100	-	2 hours	-	-
Painting					
B.A. Part I	75	-	-	-	-
B.A. Part II	75	-	-	-	-
Faculty of Science Department of Chemistry					
B.Sc. Part I	50	-	4 hours	-	-
B.Sc. Part II	50	-	4 hours	-	-
M.Sc. Previous	150	-	6 hours	-	-
M.Sc. Final	150	-	6 hours	-	-
Department of Agriculture					
M.Sc. Agri. Prev.	200	-	6 hours	-	-
M.Sc. Agri. Final	200	-	6 hours	-	-
Department of					

Physics					
B. Sc. Part I	50	-	3 hours	-	-
B. Sc. Part II	50	-	3 hours	-	-
M. Sc. Prev.	-	-	6 hours	-	-
M. Sc. Final	-	-	6 hours	-	-
Department of Electronics & Tele Communication					
B. Tech. Part I	240	165	6 hours	-	-
B. Tech. Part II	240	160	6 hours	-	-
B. Tech. Part III	225	175	6 hours	-	-
M. Tech. Part I	240	160	6 hours	-	-
M. Tech. Part II	240	160	6 hours	-	-
M. Sc. (Applied Physics)	240	160	6 hours	-	-
Department of Zoology					
B. Sc. Part I	45	5	4 hours	-	-
B. Sc. Part II	45	5	4 hours	-	-
M. Sc. Previous	180	20	6 hours	-	-
M. Sc. Final Agri.	200	50	6 hours	-	-
M. Sc. Zool.					
Part I	180	20	6 hours	-	-
Part II	200	50	6 hours	-	-
Department of Botany					
B. Sc. Part I	45	5	4 hours	-	-
B. Sc. Part II	45	5	4 hours	-	-
M. Sc. Prev.	90	10	-	-	-
M. Sc. Final	130	20	-	-	-
M. Sc. (Agri.) Botany					
Previous	90	10	-	-	-
Final	130	20	-	-	-
Department of Bio-Chemistry					

Home Sc. I	150	-	4 hours	-	-
Home Sc. II	175	-	4 hours	-	-
M. Sc. Bio-Chemistry					
Previous	200	-	6 hours	-	-
Final	200	-	6 hours	-	-

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2. Banaras Hindu University:

So far the information regarding the practical examinations for the various courses has not been received from this University.

3. Central Institute of English & Foreign Languages:

This institute does not conduct any practical examinations for the courses.

4. Maharishi Daya Nand University, Rohtak:

Following are the courses in which practical examinations are held:

- i) Under-Graduate (Pre-Uni., Pre-Engg., Pre-Med., T.D.C. I, II, III)
- ii) Post-Graduate
- iii) Medical Examinations/Prof. Exams
- iv) GAMS/BAMS (Ayurveda)
- v) Bachelor of Education (B.Ed.)
- vi) Certificate course in Secreterial Practice (C.C.S.T.)
- vii) Diploma in O.M.S.T. (Office Management & Secretarial Training)
- viii) Certificate Course in French/German.

In all the above mentioned disciplines, the practical examinations are held annually. A detailed description of the practical examination is given in the table.

S. No	Name of the subject	Pre-University Max. Marks	Pre-University Time hrs.	Pre-Medical Max. Marks	Pre-Medical Time hrs.	Pre-Engg. Max. Marks	Pre-Engg. Time hrs.	T.D.C I Max. Marks	T.D.C I Time hrs.	T.D.C. II Max. Marks	T.D.C. II Time hrs.	T.D.C. III Max. Marks	T.D.C. III Time hrs.
1.	Physics	50	4	60	4	60	4	60	4	60	6	60	6
2.	Chemistry	50	4	60	$4\frac{1}{2}$	60	$4\frac{1}{2}$	60	$4\frac{1}{2}$	60	7	60	8
3.	Botany	25	3	30	3	-	-	60	3	60	$3\frac{1}{2}$	60	$3\frac{1}{2}$
4.	Zoology	25	3	30	3	-	-	60	3	60	3	60	3
5.	Geography	-	-	-	-	-	-	B. A. 25 B. Sc. $37\frac{1}{2}$	3 3	B. A. 25 B. Sc. $37\frac{1}{2}$	3 3	B. A. 25 B. Sc. $37\frac{1}{2}$	3 3
6.	Psychology	50	3	-	-	-	-	40	3	40	3	40	3
7.	Home Science	100	6	-	-	-	-	-	-	-	-	-	-
8.	Music (Vocal)	100	20'	-	-	-	-	60	20'-30'	60	20'-30'	60	20'-30'
9.	Music (Instrumental)	100	20'	-	-	-	-	60	20'-30'	60	20'-30'	60	20'
10.	Dance	100	3	-	-	-	-	60	45'	60	45'	60	45'
11.	Drawing, Painting & Arts.	100 each	5 each	-	-	-	-	65each	5each	65each	5each	65each	5each
12.	Type writing	80	1	-	-	-	-	-	-	-	-	-	-
13.	Military Science	50	3	-	-	-	-	40	3	40	3	40	3
14.	Agri. (Biology)	20	-	-	-	-	-	-	-	-	-	-	-
15.	Agriculture (Chem.)	50	-	-	-	-	-	-	-	-	-	-	-
16.	Agriculture (Soil management & crop culture)	30	-	-	-	-	-	-	-	-	-	-	-
17.	Phy-cum-Maths.	50	-	-	-	-	-	-	-	-	-	-	-
18.	French(Viva voce)	40	-	-	-	-	-	25	-	25	-	25	-

(B) Post-Graduate Classes (M.A./M.Sc.)

S. No.	Subject	Max. Marks External	Max. Marks Internal	Time
	M.Sc. Previous			
1.	Physics (M.Sc. Prev.) (Two Practicals)	100 each	-	6 hrs. each
2.	Chemistry,(M.Sc. Prev.) (One Practical)	200	-	18 hrs. (spread over 3 days)
	M.Sc. Final			
1.	Physics (Two Practicals)	100 each	-	6 hrs each
2.	Chemistry (One Practical)	200	-	18 hrs. (spread over 3 days)
	M.A. Previous			
1.	Music (Vocal & Instrumental) (Two Practicals)	100 each	-	-
	M.A. Final			
1.	Music (Vocal & Instrumental) (Two Practicals)	100 each		3 hrs.each

(C) Medical Examinations

S. No.	Name of Speciality	Marks for Practical	Time
	Diploma Courses Part I		
1.	D.L.O.	200	Medical examinations involve practicals clinical and viva voce. No fixed timings are possible but
2.	D.O.M.S.	100	
3.	D.M.R.D.	100	

Diploma Courses Part II

4.	D.L.O	200
5.	D.O.M.S.	400
6.	D.M.R.D.	200

Diploma Courses

7.	D.G.O.	200
8.	D.A.	200
9.	D.T.C.D.	200
10.	D.V.D.	200
11.	D.C.H.	200
12.	D.Ortho	200

M.Sc. (Pharmacology)

13.	Pharmacology	–

M.Sc

14.	Microbiology	
15.	M.D./M.S./M.Ch.	

16. M.B.B.S. (First Professional)

i)	Anatomy	75
ii)	Physiology	75
iii)	Bio-Chemistry	40

17. M.B.B.S. (Second Professional)

i)	Pathology & Microbiology	130
ii)	Pharmacology	130
iii)	Forensic Medicine	65

18. M.B.B.S (Final Professional)

i)	Social & Prev. Medicine	80
ii)	Midwifery & Gyanal	220
iii)	Surgery	220
iv)	Ophthalmology & E.N.T	220
v)	Medicine	220

on an average these practical examinations take

about 8 hours a day in various departments.

19. Diploma in Pharmacy & Dressers Course (Preliminary)

i)	Gen. (Inorganic & Physical)Chemistry	100
ii)	Physics	100
iii)	Biology (Botany & Zoology)	100
iv)	Anatomy, Physiology & Health Education	100

20. Diploma in Pharmacy & Dressers Course (Final)

i)	Gen. Pharmacy	100
ii)	Dispensing Pharmacy	100
iii)	Pharmaceutical Chemistry including G. Chemistry	100
iv)	Pharmacology	100
v)	Surgery including surgical ward work	50

(D) AYURVEDA (G. A. M. S. /B. A. M. S.)

S. No.	Subject	Pre-Ayurveda	First Prof.	Second Prof.	Third Prof.	Final Prof.
1.	Science	100 marks	-	-	-	-
2.	Biology	100 marks	-	-	--	-
3.	Shareer Rachna Vigyan	-	100 marks	-	--	-
4.	Shareer Kirya Vigyan	-	100 marks	-	-	-
5.	Dravyaguna	-	-	100 marks	-	-
6.	Ras-Shastra	-	-	100 marks	-	-
7.	Swasth-Vritta	-	-	100 marks	-	-
8.	Agad-Tantra	-	-	-	100 marks	-
9.	Nidan	-	-	-	100 marks	-
10.	Parsooti-Tantra	-	-	-	-	100 marks
11.	Kaya-Chikitsa	-	-	-	-	100 marks
12.	Shalya-Tantra	-	-	-	-	100 marks
13.	Shalakya-Tantra	-	-	-	--	100 marks

	B. A. M. S.	Pre-Ayurveda	First year	Second year	Third year	Fourth year	Final ye
1.	Sanskrit	45 + 5 marks	-	-	-	-	-
2.	Prarambhik Padarth Vigyan	45 + 5 marks	-	-	-	-	-
3.	Udbhijang Pratyang Vigyan	45 + 5 marks	-	-	-	-	-
4.	Prarambhik Ras-Shastra	45 + 5 marks	-	-	-	-	-
5.	Padarth-Vigyan	-	45 + 5marks	-	-	-	-
6.	Shareer Rachna Vigyan	-	-	180+20marks	-	-	-
7.	Shareer Kirya Vigyan	-	-	180+20marks	-	-	-
8.	Swasth-Vritta	-	-	45+5 marks	-	-	-
9.	Dravyaguna	-	-	-	135+15marks	-	-
10.	Ras-Shastra & Bhaishja Kalpna	-	-	-	135+15marks	-	-
11.	Agad-Tantra & Vyava-haryur-veda	-	-	-	45+5 marks	-	-
12.	i) Roga Vigyan & Vikirti Vigyan A	-	-	-	45+5 marks	-	-
	ii) Roga Vigyan & Vikriti Vigyan B.	-	-	-	45+5 marks	-	-
13.	Parsooti Tantra & Stri Roga	-	-	-	-	90+10marks	-
14.	Kaumarbhritya	-	-	-	-	45+5 marks	-
15.	Yoga	-	-	-	-	45+5 marks	-
16.	Kaya Chikitsa	-	-	-	-	-	180+20 marks
17.	Shalya Tantra	-	-	-	-	-	90+10 marks
18.	Shalakya Tantra	-	-	-	-	-	90+10 marks

Note: The practical examinations in each subject in Ayurveda are conducted in shifts morning and evening. Morning shift is usually from 9.00 A.M. to 12.00 P.M. while evening shift is from 2.00 P.M. to 5.00 P.M.

(E) (Bachelor of Education) B. Ed.

S. No.	Subject	Marks	Time
1.	Black-Board Writing & Sketching	20	
2.	Skill-in-teaching (Two Practicals)	100 each	No fixation of time
3.	Work experience (Part-C)	50	

(F) C. C. S. T. (Certificate Course in Secretarial Practice)

1.	Shorthand (English or Hindi)	100	10 minutes- dictation
2.	Type-writing (English or Hindi)	100	2.45 hrs. for transcription

(G) O. M. S. T. (Diploma in Office Management & Secretarial Training)

OMST -I

1.	Type-Writing (English or Hindi)	50	One hour
2.	Shorthand (English or Hindi)	100	

OMST -II

1.	Shorthand (English or Hindi)	100		(10 minutes dictation and 2.45 hrs. transcription with 5 minutes break)
2.	i) Practical Training report	25	50	
	ii) Viva-voce	25		

(H) (Certificate Course in French & German)

French

Viva-voce	50 marks	-

German

Viva-voce	50 marks	-

5. Gujarat Ayurveda University:

The practical examinations in the following subjects are held twice in a year i.e. in April and in October. In first year post-graduate examination i.e. First M.D. (Ayurved) practical examinations are held in the following subjects each of which has 50 marks.

Compulsory subjects

1. Basic Principles & History of Ayurved
2. Sharir
3. Dravyaguna and Rasa-Shastra

Optional Subjects

Group A.

4. Kaya chikitsa
5. Rog Nidan

or Group B

4. Shalya - Shalakya
5. Kaumar Bhritya

In final M.D. (Ayurved), a student has to appear in any one speciality of the following subjects and he has to give practical examination of 100 marks there in:

i) Basic Principles
ii) Kaya-Chikitsa
iii) Dravya Guna
iv) Rasashastra & Bhaisajya Kalpana
v) Shalya-Shalkya
vi) Kaumar Bhritya.

6. South Gujarat University:

Following are the subjects in which practical examinations are held: i) Science ii) Medicine iii) Engineering iv) Rural Studies (master's course).

The practical examinations in all the given subjects are held annually. The duration for all the practical examinations is two to three hours and the range of marks is between 25 and 100.

7. Gauhati University, Gauhati

Following are the courses in which practical examinations are held: i) Pre-University Science, ii) B. Sc., iii) M. Sc.; iv) B. T., v) Diploma in Statistics, vi) Medicine, vii) Engineering.

In B. Sc. 50% of the total marks are reserved for practical work internally assessed and these marks are standardised against the external practical marks before adding them together. Only in the medical course, the practical examinations are held semester-wise, where as in the other courses practical examinations are held annually. However, the total number of marks allotted for different courses vary. Their table is given below:

Course	Total marks	Practical	Sessional or Internal	Whether held semester wise or annually
P. U. (Science)	900	150	-	Annual
B. Sc.	1000	300	-	Annual
M. Sc.	800	300	-	Annual
B. T.	950	200	100	Annual
Diploma in Statistics	500	100	-	Annual
Medical	4250	555	305	Semester wise
Engineering	7400	400	3600	Annual

8. Indian Institute of Technology, Kanpur

Each course at this Institute is assigned a certain number of contact hours for theoretical study (consisting of lectures, tutorials class work, home assignments etc.) and practicals in laboratory/

workshop. In general, on an overage a student in B. Tech. Programme, in the prescribed period of five years, has to go through about 3200 hours of theory and about 1100 hours of practicals. This ratio between theory & practicals is also maintained in evaluating a student's total academic performance. The system of examination provides continuous evaluation in the form of two mid-semester tests held at intervals of about five weeks and one end semester examination held after about 18 weeks of the commencement of a semester. In addition to these there are short term tests in the form of quizes. No interval is fixed for these short term tests which are held some times even without prior notice but on an average such short term tests are held once in a fortnight. No detailed information regarding the distribution of marks is given in the letter.

9. Jamia Millia Islamia, Jamia Nagar, New Delhi-25

Following are the courses in which the practical examinations are held:

i) B. A. (Pass/Hons) Geography
ii) B. Sc. (Pass/Hons) Physics, Chemistry

In M. A. (Social work) and B. A. (Hons.) in social work there is field work for students. The University has adopted semester system in all post-graduate courses from the last year & in which continuous assessment has been included for the purpose of evaluation. The ratio of credit hours in respect of continuous assessment and external examination is 2:3. The numerical conversion of the ratio is 40:60 marks respectively. For all the practical examinations the range of marks is 30 to 75 with a duration of 3 hrs to 4 hrs.

10. Jawahar Lal Nehru Krishi Vishwa Vidyalaya Jabalpur, Madhya Pradesh.

Following are the courses in which practical examinations are held:

i) B. Sc. (Ag.) ii) B. V. Sc. & A. H., iii) B. Tech. (Agr. Engg.)
iv) M. Sc. (Ag.) v) M. V. Sc. & A. H. vi) Ph.D.

Practical examinations are not held annually. There are three examinations in a semester:

a) Mid-term examination with 20% weightage

b) Practical examination with 30% weightage

c) Semester final examination with 50% weightage

The duration of the time allotted for the practical examination is of three hours. The assessment of the performance of students in a semester is done at the end of each semester.

11. Kashi Vidyapith, Varanasi-2

Following are the courses in which practical examinations are held:

i) B. A. Psychology ii) M. A. Psychology.

The practical examinations in both subjects are held annually. The total marks allotted for the B. A. practical examination are 50 and for M. A. 100. The duration is of 3 hours for the examinations.

12. University of Mysore

Following are the courses in which practical examinations are being held:

i) B. E. ii) B. Tech iii) M. B. B. S. iv) B. D. S. v) B. Pharm
vi) B. S. A. M. vii) M. E. viii) M. Tech.

In courses like B. E., B. Tech., B. D. S. and B. Pharm practical examinations are held at the end of each semester (100 marks) and likewise in courses like B. Sc. and M. Sc;. All the practical sessions are assessed internally, the maximum marks being 40%. In the courses like M. B. B.S., B. S. A. M., M. D., M. S., practical examinations are annual with a maximum of 100 marks.

13. Post-Graduate Institute of Medical Education and Research, Chandigarh

The practical examinations are held for all the examinations conducted by this Institute. The various degrees/diplomas for which the examinations are held by this Institute are as follows:

i) M.D. (Doctor of Medicine)
ii) M.S. (Master of Surgery)
iii) M.Ch. (Magister Chirurgiae)
iv) D.M. (Doctor of Medicine)
v) M. Sc. (Master of Science)
vi) M. Sc; Med. Tech. (Master of Science in Medical Techonolgy.
vii) B. Sc. Medical Technology
viii) Diploma for operation theatre Asstt.

14. College of Home Science, Punjab Agriculture University, Ludhiana

Following are the courses in which practical examinations are being held:

i) Child development ii) Clothing & Textiles iii) Home Science education & Extension iv) Foods & Nutrition v) Home Management.

In all the above mentioned courses the practical examinations are held on the trimester pattern. The assessment of the practical work is generally made once in a week during the practical hours.

15. Punjab Agricultural University, Ludhiana

All the practical examinations in this university are held at the end of the trimester. In agricultural engineering programme, 10 engineering practical courses are given to the students over a period of $3\frac{1}{2}$ years. These courses are:

i) Tractor Driving ii) Machine Shop iii) Engineering Measurement and Computation iv) Field operation & Maintenance of Tractor Machinery v) Surveying and Construction Practices vi) Pumps and Tube Wells. vii) Tractor Maintenance & Minor

Repairs viii) Electrical Engg. Practices. ix) Drying, Grading & Milling.

16. Punjabrao Krishi Vidyapeeth, Akola

Following are the courses in which practical examinations are held:

i) B. Sc. (Agr.) ii) B. V. Sc. & A. H. iii) B. Tech. (Agr. Engg.) iv) B. Sc. (Agr. Engg.) v) M. Sc. (Agr.) vi) M. V. Sc.

Common semester and practical examination is conducted by an external examiner with the help of the course teacher. Internal assessment for all the examinations has 50% of the total marks with a two hour duration.

17. Panjab University

Generally, the practical examinations in this university are being held in all the subjects, annually as well as semester-wise, except in a few listed below:

i) Diploma Course in Gandhian Philosophy ii) M. Lib. Sc. iii) B. Lib. Sc. iv) L. L. B. v) L. LM. vi) B. Com. vii) O. T. / MIL.

18. College of Veterinary Science, P. A. U , Ludhiana

The practical examinations in this university are held in all the subjects. The university has adopted the end trimester system. For all practical examinations only internal assessment is carried out. The time duration for all practical examinations is two hours.

19. College of Basic Sciences & Humanities, P. A. U., Ludhiana

Following are the courses in which practical examinations are held at this Institute:

i) Zoology ii) Physics iii) Microbiology iv) Genetics v) Maths & Statistics vi) General language & Culture.

A certain percentage of the practical marks is given to the students regularly in recording the practicals. About 1/3 of the practical marks are reserved for the viva voce. The system in this university is the trimester system, each trimester consisting of fourteen weeks. The duration of the practical examination is one hour to three hours and the range of marks is between 25% to 40%.

20. University of Poona

Recently examination reforms were introduced in this University at Undergraduate and Post graduate levels in all the faculties-except the faculty of education. 40 marks are assigned for internal assessment practical and 60 marks are assigned for external practicals. Following are the courses in which practical examinations are held:

i) Three year B. Sc. Degree Course (All Subjects except Mathematics)
ii) Three year B. A. Degree Course (Only in the subjects of Psychology & Geography)
iii) Pre-Degree Course (Only in Science subjects - Physics, Chemistry & Biology)
iv) Post-graduate course in science subjects (except Mathemetics)
v) Post-graduate course in social sciences. (Only in the subjects of Psychology & Geography)
vi) Bachelor of Education
vii) Medical Degree Courses
viii) Engineering Degree Courses
ix) Ayurved Degree Courses

Practical examinations for all courses are held annually as well as semesterwise. The range of the marks for the given courses is 50 to 100 and the duration of the examinations varies from 2 hours to $7\frac{1}{2}$ hours at different levels.

21. Rabindra Bharati University

Following are the courses in which practical examinations are being held in this university.

i) M.A. in Music, Dance, Drama & Painting
ii) Senior Diploma in Music, Dance & Drama
iii) Junior Diploma in Music, Dance & Drama
iv) B.A. in Music, Dance, Drama & Painting.

A brief description of the marks and time allotted for the above mentioned practical examination is given below:

S. No.	Name of the course in which Practical examinations are held	End Annual	Total marks for the practical exam.	Duration	Mode of Assessment
1.	M.A. (Vocal Music)	Annual	400	19 days	nil
2.	M.A. (Instrumental Music)	-do-	400	6 days	"
3.	M.A. (Dance)	-do-	350	6 "	"
4.	M.A. (Drama	-do-	300	16 "	"
5.	M.A. (Painting)	-do-	400	25 "	"
6.	Senior Diploma Vocal music)	-do-	700	17 "	"
7.	Senior Diploma (Percussion Music)	-do-	700	6 "	"
8.	Senior Diploma (Drama)	-do-	700	12 "	"
9.	Senior Diploma (Dance)	-do-	600	5 "	"
10.	Junior Diploma (Dance)	-do-	300	6 "	"
11.	Junior Diploma (Vocal music)	-do-	300	8 "	"
12.	Junior Diploma (Percussion music)	-do-	300	6 "	"

13.	Junior Diploma (Instrumental music)	-do-	300	6	"	"
14.	Higher Diploma (Vocal Music)	-do-	500	11	"	"
15.	Higher Diploma (Dance)	-do-	500	8	"	"
16.	Higher Diploma (Drama)	-do-	500	10	"	"
17.	Pre-Degree (Dance)	-do-	300	7	"	"
18.	Pre-Degree (Instrumental Music)	-do-	300+100	3	"	"
19.	Pre-Degree (Vocal Music)	-do-	300+100	9	"	"
20.	Pre-Degree (Drama)	-do-	300+100	3	"	"
21.	Pre-Degree (Percussion Music)	-do-	300+100	3	"	"
22.	Pre-Degree (Painting)	-do-	300+100	2	"	"
23.	B.A. (Vocal Music Hons. & Elective)	-do-	600	26	"	"
24.	B. A. (Instrumental Music Hons. & Elective)	-do-	650	8	"	"
25.	B. A. (Drama Hons. & Elective)	-do-	580	11	"	"
26.	B. A. (Dance Hons. & Elective)	-do-	700	8	"	"
27.	B. A. (Painting Hons. Elective)	-do-	800	34	"	"

22. Ravishankar University, Raipur

Following are the courses in which practical examinations are held in this university:

i) B. Sc. Preliminary & B. H. Sc. Preliminary
ii) B. Sc. Previous & B. H. Sc. Previous
iii) B. Sc. Final & B.H. Sc. Final
iv) M. Sc. Previous & Final - (Physics, Chemistry, Botany, Zoology, Geography, Anthropology, Psychology)
v) B. A. Music
vi) M. B. B. S. Ayurved, Engg.
vii) B. Ed.
viii) M. Ed.
ix) M. A. Previous/Final
x) L. L. B. Final

In all these courses practical examinations are held annually with a duration of three hours to four hours.

23. Rohilkhand University

Following are the subjects in which practical examinations are held in this university:

i) B. A.
ii) B. Sc.
iii) B. Sc. (Ag.)
iv) M. A.
v) M. Sc.
vi) B. Ed.

A brief description of the practical examinations in various subjects with marks and duration is as follows:

Names of the courses in which Practical Examinations are being held

Class	Subject	Maximum marks	Minimum marks	Duration of time
B. A. Part I & II	Psychology	30	10	
	Military Studies	40	13	
	Drawing &			

	Painting	70	(Two Practicals, each 35 marks)	12	
	Geography	30		10	
	Music (Vocal/ Instrumental)	50		17	
	Home Science (B. A. , Part I)	20		07	
	Home Science (B. A. Part II)	30		10	
	Statistics	40		13	
B. Sc. Part I & II	Chemistry	50		17	4 hrs
	Physics	50		17	4 "
	Zoology	50		17	3½ "
	Botany	50		17	4 "
	Military Studies	50		17	4 "
	Statistics	50		17	4 "
	Geography	50		17	
B. Sc. (Ag.) Ist year (3 year course)	Mathematics & Statistics	50		17	
	Soil, Fertilizer & manures	50		17	
	Botany	50		17	
	Agronomy	50		17	
	Agricultural Engineering	50		17	
	Agricultural Economics	50		17	
B. Sc. (Ag.) IInd year	Soil Conservation	50		17	
	Agronomy	50		17	
	Agriculture Biochemistry	50		17	
	Animal Husbandry	50		17	
	Genetics & Plant Breeding	50		17	
	Olinculture & Floriculture	50		17	

B. Sc. (Ag.) IIIrd year.	Entomology	50	17	
	Plant Pathology	50	17	
	Agriculture Extension	50	17	
	Dairying	50	17	
	Pomology	50	17	
	Dairy Chemistry & Nutrition	50	17	
M. A. (Prev. and Final	Geography	100	36	
	Psychology	100	36	2 days
B. Ed.		200	80	
M. Sc. Prev. & Final	Chemistry	200	80	12 hrs. (2 days 6 hrs. per day)
	Physics	200	80	
	Zoology	200	80	
	Botany	200	80	-do-

24. Sardar Patel University

Following are the courses in which practical examinations are being held:

(A) In the faculty of science, practical examinations are prescribed in the subjects of Physics, Chemistry, Botany, Zoology, Microbiologyand Statistics at all levels.

(B) In the faculty of Engineering and Technology practical examinations are prescribed in some of the Engineering subjects.

In the science and engineering faculties practical examination is conducted at the end of each semester. In the science faculty each practical is of 75 marks and in the Engineering faculty it varies from 25 marks to 100 marks. In the science faculty grading system is introduced at the F. Y., B. Sc. and M. Sc. level. At the F. Y. B. Sc. examination practical examination is of 3 credits and at the M. Sc. level it is of 6 credits for each semester. The time allotted for each practical is three hours. In the science faculty internal evaluation is prescribed and the ratio between External and Internal is 2:1 upto degree level and at the post-graduate level it is 50:50.

25. University of Saugar

Only the Department of Education has furnished the information regarding the practical examinations. In the faculty of Education they are held semesterwise (twice in a year) - One at the end of practice teaching after completion of 20 lessons in each subject i.e. in all they have to teach 40 lessons. Second phase starts during the session pupil teachers are sent to various practising schools for teaching. They are assessed by supervisors and after every programme of teaching their assessment is consolidated and final assessment is tabulated which forms the basis of Internal assessment. M.Ed. Students have to conduct 10 Psychological practicals during the session and they are examined on it in the viva voce after their theory exams.

26. Sambalpur University, Jyoti Vihar Burla, Sambalpur.

Following are the courses in which practical examinations are held:

M.A/M.Sc./Dip. Courses: Physics, Chemistry, Botany, Zoology, Home Science, Bio-Science, Diploma Course in Lib. Science, Statistics.

A detailed description of practical examinations in all these subjects is given below:

S. No.	Name of the Course	Annual/ Semester	Number of marks	Duration	Remarks
1.	Physics	Semester	100	6 hrs.	The M.A./ M.Sc. examinations are completed in 4 semesters
2.	Chemistry	-do-	100	6 hrs.	
3.	Botany	-do-	100	3hrs.(6 hrs)	
4.	Zoology	-do-	100	3hrs.(6hrs)	

5. Bio-Science	-do-	100	3hrs.(6hrs)	and the diploma course in Lib. Science examination is completed in 2 semesters.
6. Home Science	-do-	100	3hrs.(6hrs)	
7. Dip. Course in Lib. Sc.	-do-	200	6 hrs.	
8. Statistics	-do-	50	-	

Name of the Course	Annual/ Semester	Number of marks	Duration	Remarks
B. A./B. Sc.				
(Physics, Chemistry Biology, Statistics, Geography, Geology Education Anthropology, Psychology, Home Science.)	In all these subjects examinations are held at the end of the 2 year course	100/300 marks in each subject.	6hrs.	The practical examination in each subject is conducted by two examiners viz. one external and one internal at the end of the course.

27. Sampurnanand Sanskrit University, Varanasi.

No such courses of study have been prescribed in the syllabus of this University in which practical examinations are to be taken.

28. Shivaji University, Kolhapur

The details of the practical examinations in various courses of this university are given here as follows:

Subject	Examination	Marks	
First M. B. B. S.,			
Anatomy	Semester	300	Practical and oral
Physiology	Semester	200	-do-
Bio-Chemistry	Semester	100	-do-
Second M. B. B. S.			
Pathology	Annual	100	Practical
Pharmacology	Annual	100	-do-
Third M. B. B. S.			
Medicine	Annual	100	Practical and oral
Surgery	Annual	100	-do-
Preventive and Soc. Medicine.	Annual	100	-do-
Midwifery	Annual	100	-do-

Subject	Examination	Marks for final Exam.	Sessional marks	Total	Time
First B. Pharm.					
Biology	Annual	60	40	100	4 hrs.
Physics	"	60	40	100	4 hrs.
Gen. Chemistry	"	60	40	100	4 hrs.
Engg. Drawing	"	60	40	100	4 hrs.
Second B. Pharmacy					
Human Anatomy and Physiology	"	60	40	100	4 hrs.

Engineering Drg.	"	60	40	100	4 hrs.
Org. Chemistry	"	60	40	100	6 hrs.
Physical Chemistry	"	60	40	100	6 hrs.
Physics	"	60	40	100	4 hrs.
Third B. Pharm.					
Pharmaceutical Chemistry	"	60	40	100	6 hrs.
Bio-Chemistry	"	60	40	100	4 hrs.
Preparatory Pharmacy	"	60	40	100	4 hrs.
Dispensing Pharmacy	"	60	40	100	4 hrs.
Pharmacognosy-I	"	60	40	100	4 hrs.
Pharmaceutical Engg.	"	60	40	100	4 hrs.
Fourth Year Pharm.					
Pharmaceutical Chem. -II	"	60	40	100	6 hrs.
Pharmaceutical Chem. -III (Analytical)		60	40	100	6 hrs.
Pharmaceutical Engg. II	"	60	40	100	6 hrs
Pharmaceutical Preparations.	"	60	40	100	4 hrs.
Pharmacology and Bioassery	"	60	40	100	4 hrs.
Pharmacognosy	"	60	40	100	4 hrs.

Subject	Examination	Marks for Practical and Oral
Pre-Ayurved		
Prarambhik Padarth Vigyan	Annual	50
Udbhijjang Pratyanga Vignyan	"	50
Prarmbhik Rasashastra Parichaya	"	50
Main Ayurved		
Padartha Vigyan	"	50
Sharir Rachana Vigyan	"	200
Sharir Kriya Vigyan	"	200
Swastha Vritta	"	50
Dyaryaguna Vigyan	"	150
Rasashastra and Bhaishajya Kalpana.	"	150
Roga Vigyan and Vikriti Vigyan	"	100
Prasuti Tantra and Stree Roga	"	100
Kaumarabhritya	"	50
Agada Tantra and Vyavaharayurveda	"	50
Kayachikitsa	"	200
Shalya Tantra	"	100
Shalakya Tantra	"	100

B. Com. Part-III Accountancy	End of each semester.	

Sem. III and IV Accountancy	"	20
B. Com. Part-II Sem. I and II Accountancy	"	20
B. Com. Part-I Accountancy	End of year	10

Practical Examinations in the B. Sc. Part -I

Subject	Examination	Marks
1. Physics	Annual	60
2. Chemistry	"	"
3. Botany	"	"
4. Zoology	"	"
5. Statistics	"	"
6. Geology	"	"
7. Geography	"	"
8 Microbiology	"	"
9. Psychology	"	"

PRACTICAL EXAMINATIONS IN THE B. Sc. II & III

Subject	Examination	Marks for		Time for B. Sc. II	Time for B. Sc. III
		B. Sc. II	B. Sc. III		
1. Physics	Annual	75	150	Two days 3 hours each day	Two days 3 hours each day
2. Chemistry	"	75	150	Two days six hours each day an hours recess.	Three days six hours each day half hours recess.
3. Botany	"	75	150	Two days $4\frac{1}{2}$ hours each day	Four days $4\frac{1}{2}$ hours each day
4. Zoology	"	75	150	-	-
5. Geology	"	75	150	Two days not less than five hours each day	Four days not less than five hours each day
6. Geography	"	75	150	Two days four hours each day	Two days four hours each day
7. Meteorology	"	75	150	Two days $4\frac{1}{2}$ hours each day	Four days $4\frac{1}{2}$ hours each day.
8. Microbiology	"	75	150	Two days five hours each day	-
9. Statistics	"	75	150	One day not less than three hours	4 days
10. Experimental Psychology	"	50	100	Two days three hours duration	Two days three hours duration

PRACTICAL EXAMINATIONS AT M. Sc.

Subject	Examination	Marks
1. Physics	At the end of each semester	100 marks
2. Chemistry	-do-	100 marks
3. Botany	-do-	-do-
4. Zoology	-do-	-do-
5. Geography	-do-	-do-

Practical Examinations at Bachelor of Physical Education (B. P. Ed.)

	Examination	Marks
1. Practical-Examination (External Assessment)	Annual	175
2. Practical-Examination (Internal Assessment) (Term-Work)	Annual	525

1. B. A., B. Ed. (Special) Course.

First Year B. A., B. Ed. (Special)	
Part -II - Practicals	100 marks
Second Year B. A., B. Ed. (Special)	
Part II Practicals	100 marks
Third Year B. A., B. Ed. (Special)	
Part -II Practicals	200 marks

Final Year B.A., B.Ed. (Special)

Part -II Practicals	300 marks

2. B.Ed. Revised Course

Part-II

Practical Examination in the two subjects offered for Paper -V. 200 marks.

Revised Four-Year Degree Course in Engg.
Introduced from the Academic year 1972-73

	Subject	Examination in Semester	Practical and oral marks	Oral examination
Second year (Civil)	Surveying -II	2nd	50	-
Third Year (Civil)	Engg. Hydrology and Geology	Ist	50	-
Third Year (Civil)	Concrete Technology and R.C.C.	2nd	-	75
Third Year (Civil)	Design and Drwg.	2nd	-	50
Final Year (B.E. (Civil)	Structural Design and Drawing -II	2nd	-	75
Final Year (B.E. (Civil)	Project Drawing	2nd	-	75
Third Year (Mechanical)	Thermodynamics -IV	2nd	50	-
Third Year (Mechanical)	Machine Design-I	2nd	-	50

Final (Fourth) Year (Mechanical) B. E.	Machine Design--III	2nd	-	50
Final (Fourth) Year (Mechanical) B. E.	Elective-II	2nd	-	50
Second Year (Electrical)	Elect. Measurements	1st	50	-
Third Year (Electrical)	Electrical Machines -III	2nd	50	-
Third Year (Electrical)	Applied Electronics -I	2nd	50	-
Final (Fourth Year) Electrical B. E.	Electrical Machines-IV	Ist	50	-
Final (Fourth Year) Electrical B. E.	Applied Electronics -III	2nd	50	-
Final (Fourth Year) Electrical B. E.	Electrical Design and Drawing -II	2nd	-	75

Practical Examination
at B. Lib. Sc. Course

Subject	Examination	Marks	Duration
Practical test in Library classification according to colon Classifications (6th amended) and decimal classification (18th ed)	Annual	100	Three Hours
Practical test in Library Cataloguing according to classified catalogue code (5th ed.) and Anglo-American Cataloguing Rules	-do-	100	Three Hours

(North American Text-1967)			
A viva-voce and Practical Test in Reference Service	-do-	50	Not more than 15 minutes
Record of Practical work	-do-	50	

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29. Tamil Nadu Agriculture University

The trimester system of teaching is followed in this university. Under this system, the final test carries 30 marks. Out of 30 marks, 15 marks are assigned to practicals wherever the course carries practicals (that information is not given). The final test and practical examinations are conducted at the end of each trimester when a viva-voce is also conducted, a maximum of 5marks out of 15 are allotted for it.

30. Tata Institute of Social Sciences, Bombay

No such courses of study have been prescribed in the syllabus of this University in which practical examinations are to be taken.

31. Indian Agricultural Research Institute, New Delhi

This University in conducting Post-graduate Courses in the faculty of Agriculture. The Institute follows the course-credit system and has 370 courses. Out of these 370 courses for which theory classes are held practicals have been attached to 240 courses. One credit hours of course work represents 12 lectures each of approximately one hour while a credit of laboratory work of field practical comprises of 12 practicals each of approximately 2 to 3 hours.

32. Shreemati Nathibai Damodar Thackersey Women's University

Facultywise information regarding the practical examinations is as follows:

i) Faculty of Education:- For the B. Ed. Course practical examinations are held annually. The marks allotted for the course are 100 (50 marks each for 2 Lessons)

ii) Faculty of Home Science:- The faculty has introduced semester and credit system. In this faculty all the subjects have 20% of the continuous internal evaluation in practical work and 10% at the final examination at the end of semester.

iii) Faculty of Library Science:- The practical examinations for the degree of B. Lib. Sc. are held on the basis of the semester system. Each student puts in about 22 hours supervised practical work in the various departments of the library which is continuously assessed and carries 15 marks in the second semester. Each student prepares an annotated bibliography on a specific topic. This project carries 30 marks in the second semester.

iv) Faculty of Health Nursing:- The faculty contains three years integrated course with a semester system approach. The practical examinations in all the concerned subjects are held semesterwise.

v) Faculty of Arts:- This faculty contains graduate and post-graduate courses in Music & Painting. The examinations are held annually for all the subjects with a slight variation of marks & duration for the same.

33. Jadavpur University

Given below is a list of various subjects in which practical examinations are being held in this University. Marks in practical examinations are 100 in each paper and under continuous assessment upto the under-graduate final examinations in the Faculties of Engineering & Technology and Science.

A. Faculty of Arts

i) Bachelor of Library Science	Practical examinations are held in: a) Paper-VI (Classification) b) Paper-VII (Cataloguing)

	c) Paper-VIII(Reference & Documentation work)
ii) Bachelor of education (B. Ed.)	a) Physical Science Practical b) Biological Sciences Practical c) Geography Practical d) Teaching Practical
iii) Bachelor of Education (Physical Education)	Activity Course: a) Paper-VI Formal Exercises, Rhythmics & Combatives b) Paper-VII Gymnastics, Aquatics, Athletics. c) Paper VIII Community Recreation, Recreational sports and camping. d) Paper-IX work education, National Integration and Social Service e) Paper-X Team games f) Paper-XI Practical Teaching Final. (200)

B. Faculty of Science

B. Sc. Preliminary	a) Chemistry Practical b) Physics Practical c) Geological Science Practical
B. Sc. Part I	a) Chemistry Practical b) Physics Practical
B. Sc. Final Exmination	a) Chemistry Practical (2 papers) b) Physics Practical (2 papers) c) Geological Science Practical (2 papers)
M. Sc. Part-I Exmination	a) Physics Practical (General)
M. Sc. Final Examination (Physics)	a) Physics Practical (General)

M. Sc. Part-I Examination	a) Chemistry (Organic) Practical b) Chemistry (Physical) Practical
M. Sc. Final Exam. (Chem.)	a) Inorganic Chemistry Pract. (2 papers) b) Organic Chemistry Pract. (2 Papers) c) Physical Chemistry Pract. (2 papers)
M. Sc. Part-I Examination	a) Paper-I to IV in (200 marks) Applied Geology
M. Sc. Final Exmination (Applied Geology)	a) Paper -V & VI (2 papers) (50x2 = 100 marks) b. Sessional marks 400 marks

C. Home Science Courses

Certificate Course in Art in Everyday Life.	a) Drawing & Painting Practical b) Craft Practical c) Interior Decoration & display Pract. d) House-hold Art Practical e) Clothing Construction and Fancy Needle Work Practical.
Certificate Course in Home Science	a) Home Management Practical b) Foods and Nutrition c) Clothing and Laundry d) Child Development e) Home Nursing and First Aid
B. Sc. Preliminary (Home Sc.)	a) Physics -I b) Chemistry -I c) Physiology d) Psychology
B. Sc. Part -I (Home Sc.)	a) Physics - II

	b) Chemistry -II c) Bio-Chemistry & Microbiology d) Art in Everyday Life e) Rural Development
B. Sc. Final (Home Sc.)	a) Foods & Nutrition b) Home Management c) Child Development d) Textiles & Clothing e) Hygiene and Home Nursing
Diploma Examination in Early Childhood Education	a) Teaching Practical
B. Ed. (Home Science) Exam.	a) Teaching Final Practical (200)
M. Sc. Part I (Home Sc.) Child Development.	a) Paper VI Practical
M. Sc. Final (Home Sc.) in Child Development	a) Paper-XI (Practical)
M. Sc. Part I (Home Science) in Home Management......	a) Experimental Food b) Microbiology
M. Sc. Final (Home Sc.) in Home Management	a) Thesis b) Viva on Paper -I & Paper II

D. Faculty of Engineering & Technology

i)	Ist Engg. Part-I Examination	a) Engineering Drawing-I b) Physics Laboratory-I c) Chemistry Laboratory-I
ii)	Ist Arch. Part-I Exam.	a) Physics Laboratory - b) Chemistry c) Architectural Drawing
iii)	Ist Engg. Part-II Exam.	a) Physics Laboratory

		b) Surveying Practical c) Physics Laboratory-II d) Chemistry Practical-II e) Engineering Drawing-III
iv)	Ist Arch. Part-II Exam.	a) Freehand Drawing-II b) Architectural Design
v)	Intermediate Engg. Exam.	a) Electronics Laboratory b) Workshop (Forging & Moulding c) Structures (Practical)-I d) Building Planning & Const. Practical e) E.E. Laboratory-IIA f) Geology Laboratory g) Mechanism Drawing h) E.E. Laboratory-IA i) E.E. Laboratory-II
vi)	Inter Architectural Exam.	a) Arch. Construction b) Arch. Design-II
vii)	B. Ch. E. Part-I Exam.	a) Machine Design (Practical) b) Workshop Practice
viii)	B. C. E. Part-I Exam.	a) Geodetic Survey (Practical) b) Structures-II (Practical) c) C.E. Laboratory-I d) M.E. Laboratory
ix)	B.E.E. Part-I Exam.	a) E.E. Laboratory-III b) M.E. Laboratory-A
x)	B.E. Tel.E. Part-I Exam.	a) E.E. Laboratory-II b) M.E. Laboratory c) E. T. E. Laboratory d) Design-I
xi)	B. M. E. Part-I Exam.	a) M.E. Laboratory-II b) Machine Elements Design & Drawing.

xii)	B. Met. E. Part-I Exam.	a) Design & Drawing b) Arch. Construction
E	Bachelor of Engineering Final Examinations	
xiv)	B. C. E. Final	a) C. E. Laboratory-I b) Professional Practice and Valuation (Practical)
xv)	B. Ch. E. Final	a) Unit Operations Laboratory & M. E. Laboratory b) Fuels & Instrumentation Laboratory c) Process Engineering & Technology Laboratory
xvi)	B. E. E. Final	a) E. E. Laboratory-IV
xvii)	B. E. Tel. E. Final	a) E. Tel. E. Laboratory-III b) E. Tel. E. Laboratory-IV c) E. Tel. E. Laboratory-V d) E. Tel. E. Laboratory-VI e) Design-III
xviii)	B. M. E. Final	a) M. E. Laboratory-III
xix)	B. Met. E. Final	a) Extractive Metallurgy Laboratory
xx)	B. Architecture Final	a) Practical Training (200)
F.	Department of Pharmacy	
xxi)	Preliminary Pharmacy Exam.	a) Biology Practical b) Physics Laboratory c) General Chemistry Laboratory d) Technical Drawing.
xxii)	Inter Pharmacy Exam.	a) Analytical Chemistry Laboratory

	b) Physical Chemistry Lab. c) Organic Chemistry Lab. d) Physiology Laboratory
xxiii) B. Pharmacy Part-I Exam.	a) Pharmaceutical Chemistry Laboratory b) Applied Bio-Chemistry Lab. c) Applied Microbiology Lab. d) Clinical and Operative Pharmacy.
xxiv) B. Pharmacy Final	a) Physical Pharmacy Lab. b) Pharmaceutical Control Lab. c) Pharmacology and Bio-Assay Lab. d) Pharmacognosy Laboratory e) Pharmaceutical Engg. Lab. f) Manufacturing Pharmacy and Cosmetic Technology Laboratory

G. Bachelor of Technology

xxv) Preliminary B. Tech (Food Technology & Bio-Chemical Engg.) Exam.	a) Drawing 'B' b) Workshop Practice c) Chem. of Food Laboratory-I & II d) Microbiology Lab. -I & II e) E. E. Laboratory
xxvi) B. Tech. (FTBE) Part-I Exam.	a) Food Analysis Lab. b) Fermentation Laboratory c) Workshop Practice-III
xxvii) B. Tech. (FTBE) Final Exam.	a) Food Processing Laboratory b) Bio-Chemical Engg. Lab. c) Chemical Engg. Laboratory & Mechanical Engg. Lab.
xxviii) Preliminary B. Tech. (Instrumentation & Electronics Engg. Exam.)	a) Drawing b) Workshop Practice-I c) E. E. Laboratory-I d) E. T. E. Laboratory-I

		e) Workshop Practice-II
xxix)	B. Tech (I. E. E.) Final Exam.	a) Computer Laboratory b) Industrial Instruments Lab. c) Telemetry & Remote Control Lab. d) Control Engg. Laboratory

H. Master of Engineering

i)	M. C. E. (Ist year) M. C. E. (Final)	a) Laboratory/Seminar b) Seminar/Research Work
ii)	M. Ch. E. (Ist year) M. Ch. E. (Final)	a) - b) Thesis
iii)	M. E. E. (Ist year) M. E. E. (Final)	a) - b) Thesis
iv)	M. E. Tel. E. (Ist year) M. E. Tel. E. (Final)	a) - b) Thesis
v)	M. M. E. (Ist year) M. M. E. (Final)	a) - b) Laboratory/Project/Seminar c) Thesis/Advanced Design work d) Sessional Work
vi)	M. Pharmacy (Ist year) M. Pharmacy Final	a) Advanced Pharmaceutical Analysis b) Thesis
vii)	M. Tech (FTBE)	a) Thesis

Post-Graduate Diploma in Engineering

i)	Chemical Engineering	a) Project Report b) Factory Training Report/ Special Project
ii)	Civil Engineering	a) Sessional Work (Adv.

		Laboratory work/Dissertation/Field Trip.
iii)	Electrical Engineering	a) Dissertation/Project
iv)	E & Tel. E.	a) Project Report b) Sessional Work (Laboratory work, Design work/Seminar)
v)	F. T. B. E.	a) Project Report b) Factory Training Report
vi)	Computer Science	a) Sessional b) Project Work

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34. Jawaharlal Nehru Technological University, College of Engineering, Kakinada

Following are the courses in which the practical examinations are being held:

A	i)	Physics	during the course of Ist year of the 5-year B.Tech. degree course.
	ii)	Chemistry	
	iii)	Technical Arts	
	iv)	Engineering Graphics	
B.	i)	Civil Engineering Faculty	From IInd year onwards to 5 year (B.Tech. Course)
	ii)	Electrical Engineering Faculty	
	iii)	Mechanical Engineering Faculty	
	iv)	Electronics & Communication	
	v)	Engineering Faculty	

Practical examination in the :

i) End term: for the Ist year class in various subject mentioned against **A.**

ii) 2nd semester each year from II year to V year B. Tech.

iii) End exam. at the end of each semester, final practical in various Labs. in each engg. branch will be conducted.

Marks The distribution of the marks in the above mentioned course is as follows:

75% weightage		25% weightage for final lab. examination at the end of each semester.
45% for day to day	30% for best two lab. tests in each semester.	

Time The time period for laboratory examination is divided into two parts i. e. One hour for laboratory tests and three hours for laboratory final examination.

Assessment

For laboratory test the assessment is made at least once in a month and for final examination it is at the end of a semester. Projects Viva would be conducted for final year B. Tech. class in each engineering faculty based on the project work undertaken by the students in the II semester of final year on a topic related to any specialization in the concerned engineering faculty under the guidance of Head of the Deptt., senior member of the faculty and external guide selected from any industry organization.

35. Karnataka University

The practical examinations are being held at the end of second, fourth and sixth semesters. There are two practicals of 50 marks each for core subject; and one practical of 50 marks each for elective subject; Out of 50 marks 10 marks are for

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internal assessment. These marks are meant either for record or viva-voce test. The University has introduced the six semester examinations at the degree course from the academic year 1977-78. Following are the courses in which practical examinations are being held.

i) Anthropology (M.A. Courses)
ii) M.A./M.Sc. Geography & Applied Geography
iii) Geology
iv) Bio-Chemistry
v) Botany
vi) Chemistry

Every practical carries 100 marks (the M.A./M.Sc.). For every 100 marks, 25 marks are allotted for continuous assessment and 20 marks are reserved for the neatness of the Journal work and regularity in the submission of exercises given by the course teachers. The remaining 5 marks are given for regularity in attendance as per the common scale given by the university.

36. Orissa University of Agriculture and Technology

Following are the courses in which practical examinations are being held at this university:

i) Agronomy
ii) Agricultural Chemistry
iii) Plant Breeding and Genetics
iv) Entomology
v) Mycology
vi) Horiticulture
vii) Agricultural Economics
viii) Extension Education
ix) Plant Physiology
x) Nematology
xi) Statistics
xii) Poultry Production
xiii) Dairying

xiv) Animal Husbandry
xv) Agricultural Engineering

Each subject has been divided into several distinct courses and in each course practical examinations are conducted. The time duration is 100 minutes for undergraduate courses and 3 hours are for post-graduate courses. There is no continuous assessment only one final examination is held at the end of the semester. Three other faculties also exist under this university, i. e. i) Faculty of Veterinary Science, ii) Faculty of Agricultural Engineering and iii) Faculty of Basic Sciences. The practical examination pattern in all these faculties is similar to that of the faculty of agriculture.

37. Birla Institute of Technology and Science

The practice school programme of education, a controlled simulation of the real life, adopted at B. I. T. S., creates the circumstance whereby the university is linked with its environment. In short, it is part of the total programme and takes the class room for a period of 5½ months or more to a professional location where students and faculty get involved in real life problems. The programme requires that students undergo the rigour of the professional world in form as well as in substance, thus providing them an opportunity to apply their class-room knowledge to live situations. It differs from the 'practical Training' as well as 'Sandwich Schemes' by the fact that the entire student education at practice school station is supervised by the B. I. T. S. faculty resident in the station. Credits obtained by the students at the station form a part of his total credit towards his degree.

SECTION III

AIMS AND OBJECTIVES OF PRACTICAL/LABORATORY FIELD WORK

AIMS AND OBJECTIVES OF PRACTICAL/LABORATORY/ FIELD WORK

Aims & Objectives of Practical/Laboratory/Field Work

The main intention of every teacher is to enable his students to learn concepts, principles, analysis and problem solving techniques. However, we cannot observe learning but we can observe and measure a performance. We conclude that learning has taken place if a student can do something which he could not do before he received the instruction. In order to make the teaching effective, the teacher must be able to use a more precise language which describes in behavioural terms what the students will be able to do at the end of a lesson or a course of instruction. This is necessary because a traditional type of syllabus consisting of a list of topics does not suffice this purpose, for it fails to specify just what it is the student will learn to do. When one has specified the change in behaviour that he hopes to produce in the student, then he has written an objective.

Objectives are,therefore,statements which specify in precise language what the students will be able to do at the end of the instruction. The emphasis is on doing or performance on the part of the learner. Therefore, when we start writing the objectives we must take care of terminal behaviour and criterion for the same. Here by the term 'terminal behaviour' we mean the behaviour or performance demonstrated by the learner at the end and by criterion we mean the standard or level by which terminal behaviour is evaluated. For higher levels of learning, it is necessary to list specific types of behaviour that represent each general objective and also it is essential that teaching should focus on the larger sphere of behaviour that the sample represents.

Objectives that can be attained in laboratory/practical/field work

The laboratory is often used for a better understanding of a theoretical concept, such as the virtual and the real optical image, or of a generalization, such as conservation of heat in calorimetry. In such cases, however, the principal contribution of the laboratory should be to give the student, through contact with reality, a different and truer idea of the concept or generalization that can be obtained theoretically - rather than merely a stronger or clearer idea of it. Another very common objective is to acquaint the student with various aspects of problem solving techniques; measurement, control of variables, statistical treatment of data; and, less frequently, design of experiment. A third objective of the laboratory is to teach the student how to use certain instruments. The laboratory's best contribution is not only to increase the student's store of empirical or theoretical knowledge but also to give him an insight into what is known about reality. It appears, therefore, that the central objective of introductory laboratory instruction should be to increase the student's understanding of the relation between different variables or between theoretical science and phenomena. Thus laboratory experiences give a student an opportunity to attain each of the major laboratory objectives. Generally, it is not enough merely to allow a student to come into contact with phenomena. Rather, the student's experience should be planned and guided in the light of explicit, detailed objectives. If there is a hierarchy of objectives based on their importance or difficulty, this hierarchy should inform the planning. The objectives which can be attained in a practical/laboratory/field work are given as follows:

1. Ability to remember or recall definitions, notations, operations and concepts.
2. Ability to manipulate and compute rapidly and accurately.
3. Ability to interpret symbolic data.
4. Ability to put data into symbols.
5. Ability to follow proofs
6. Ability to construct proofs
7. Ability to apply concepts to mathematical problems.
8. Ability to apply concepts to non-mathematical problems.
9. Ability to analyse and determine the operations which may be applied.

10. Ability to invent mathematical generalization.

There is a cry for greater industrial orientation and much of it can be created in laboratories and workshops. Colleges and institutions proudly display their laboratories; teachers spend lot of their time planning and developing laboratory experiments; students spend appreciable time in the laboratory and many more hours writing reports on experiments. It is therefore necessary to look at the aims and objectives of laboratory work. For constructing performance tests, these outcomes or objectives are vital. A table of specifications can be drawn up balancing the content areas with objectives.

The stated aims of the laboratory from being a supplement to lectures and a method of consolidating theoretical work to being a means of training in techniques of measurement, in handling instruments and equipment and of communication by means of a written report,are now universally accepted.

W.A.G. Easton laid down in his paper the reasons for experimental work to be:

a. to demonstrate a basic law
b. to verify the correctness of theoretical calculations
c. to show the methods of measuring physical constants
d to establish a mathematical relationship between variables
e. to teach the use of certain machines
f. to develop basic experimental techniques
g to test a machine

The University of Leicester School of Education came up with 'Taxonomy of Practical skills in Science' along Bloomian lines, namely:

1) Ability to use simple apparatus and implement simple procedures.

2) Ability to observe changes/differences in structures of system under investigation and to record such changes/differences in ways which yield maximum relevant information.

3) Ability to select appropriate appratus and/or procedures for a new experimental problem.

This can be expanded to:

1.10. Knowledge of instruments/apparatus

1.20 Knowledge of procedures

1.30 Knowledge of ways of using instruments/apparatus

1.40 Knowledge of limitations of instruments/apparatus

2.10 Ability to use apparatus/instruments

2.20 Ability to implement procedures.

2.30 Ability to select appropriate procedures/methods for a particular experiment.

3.10 Ability to observe the structures of systems under investigation.

3.20 Ability to observe changes/differences in the dimensions of the structure or systems under investigation.

3.30 Ability to record appropriately the observed structure or system and the changes occuring in it.

3.40 Ability to handle data of tests/field work and interpret them

4.00 Ability to write a report or communicate results in an acceptable form.

5.00 Ability to draw conclusions.

6.10 Ability to devise new apparatus to meet the demands of a practical problem.

6.20 Ability to devise novel procedures to solve a practical problem.

Thus the main purpose of laboratory/practical/field work is to acquaint the students with various aspects of problem solving techniques. However, some can be explained and translated in various ways. Eggleston in his note entitled "A Critical Review of Assessment procedures in Secondary School Science" reported that the objectives of laboratory work/field work are to develop the ability to use knowledge, to draw conclusions, to derive experiments, to handle data to classify and interpret, to work to given instructions and ability to make observations etc. With a slight variation to the Eggleston's reporting the objectives of the laboratory work/field work given in the Nuffield 'O' Level Chemistry. Textbook are also illustrated as the development of skill in handling materials, manipulating apparatus, carrying out instructions for experiments and making accurate observations, solving a practical problem, handling and classifying given information. In addition to the aforesaid qualities, the ability to interpret information with evidence of judgement and assessment, ability to apply previous understanding to new situations and to show creative thought.

Objectives are,therefore, the statements which communicate in precise terms the expected terminal performance of students at the completion of instruction. It is necessary to write objectives for each subject we teach because the traditional syllabus does not clearly specify what the student will learn to do. If we are not specific but only hope the students will learn in a given lesson the time may be wasted on non-examinables. Moreover, objectives provide a guide for selecting the subject matter, the teaching methods, the materials to be used during instruction, guide for constructing tests and other valid instruments and the materials to be used for instruction. There are many objectives of teaching learning and evaluation, which can be achieved by both theoretical & practical learning. We shall consider here objectives which are relevant for Laboratory/Practical/Field work. Few of the important objectives of practical/laboratory/field work are given as follows:

Aims & Objectives of Practical/Laboratory/Field Work.

1. Investigation of theoretical principles and concepts and their applications.
2. Appreciation of measurements and measurement techniques. Possibilities and limitations of simple measurements.
3. Appreciation of instruments and accessories. Familiarisation with standard measuring devices, standard control devices.

4. Appreciation of engineering practice. Use of and familiarity with typical stores system. Correct usage and storage of tools and equipment.

5. Appreciation of equipment design. Advantages of simplicity in design. In addition to it the working ranges of instruments and apparatus and the suitability of materials used.

6. Appreciation of experimental techniques.

   a) True experimental method i. e. stipulation of problem and the devising of best means and procedure for its economic solution.

   b) Conduct of experiment with clear understanding of object of experiment, and working of apparatus, and limitation.

   c) Arrangement of procedures so that mistakes are least likely to occur.

7. Appreciation of developmental technique. Basic principles of design and marriage of theory and practice.

8 Development of oral communication with the help of individual and group discussions.

9. Development of visual communication. Sketching of apparatus, line and flow diagrams.

10. Development of techniques of recording and reporting. Presentation of summarised information. Recording of readings, computation of results, types of inferences.

11. Development of teaching techniques, working as a team Organization of experimental work.

12. Development of ability to follow instructions from the sheets and manuals.

13. Development of ability to observe changes in structures of systems under investigation and to record such changes in ways which yield maximum relevant information.

14. Development of ability to select appropriate apparatus and procedures for a new experimental problem.

15. To demonstrate a basic law and to verify the correctness of theoretical calculations.

16. To establish a mathematical relationship between variables.

17. To develop the insight in planning and executing projects.

18. Development of the basic knowledge regarding the construction of the apparatus (leading to the preparation of improvised apparatus).

19. To enhance theoretical knowledge and practical skills as both are complementary to each other.

20. Development of the activities for doing rather than knowing (a concept of learning by doing)

21. To develop the insight for collecting, analysing and interpreting the data.

22. Development of the ability to make a judgement and evaluate data and information.

23. Development of the ability and resourcefulness for the preparation of scientific and technical reports.

24. Development of the level of knowledge of instruments, limitation of instruments, and ways and means of using apparatuses and instruments.

In addition to the above mentioned objectives of the practical/laboratory/field work there may be few more objectives. These are as varied as are the purposes of practical work. However, much practical/laboratory/field work must involve the application of knowledge, the use of theoretical concepts and more open ended practical investigations rather than routine practical operations. In any way the objectives should be written in such a manner as may assist teachers who are trying to decide what student behaviours are required for one to infer understanding, cognizance, or maturity. The key to making an objective behavioural lies in the verb used and thus the verbs used in the objectives are important. Similarly, the following verbs may be used to specify the objectives of laboratory science behaviours.

1. Apply
2. Calibrate
3. Conduct
4. Connect
5. Convert
6. Decrease
7. Demonstrate
8. Dissect
9. Feed
10. Grow
11. Increase
12. Insert
13 Keep
14. Lengthen
15. Limit
16. Manipulate
17. Operate
18. Plant
19. Prepare
20. Remove
21. Replace
22. Report
23. Reset
24. Set
25. Specify
26. Straighten
27. Time
28. Transfer
29. Weigh

Beside specifying the performance or behaviour of the learner, it is often helpful to specify the conditions that will be imposed upon the learner while he/she is demonstrating his/her ability to perform the objective.

SECTION IV

DESIGN OF PRACTICAL/LABORATORY/FIELD WORK EXAMINATIONS - ANALYSIS AND INTERPRETATION OF THE RESULTS

DESIGN OF PRACTICAL/LABORATORY/FIELD WORK ANALYSIS & INTERPRETATION OF THE RESULTS

DATA COLLECTION

An exhaustive questionnaire consisting of more than 100 questions on the various aspects of practical/laboratory/field work examinations was prepared to solicit the views of University/ College teachers. The questionnaire was divided into six major classes viz.

A. Scope & nature of practical/laboratory/field work
B. Objectives of practical/laboratory/field work
C. Assessment methods for practical/laboratory/field work
D. End external examination and continuous assessment.
E. Design of assessment procedures for practical/ laboratory/field work
F. Marking versus grading for practical/laboratory/ field work.

A five point scale was used to record the responses from teachers. Related to the nature of each section, items/questions were prepared. The teachers were asked to respond to the questionnaire itself. For instance, Q. No. 1.

Question No. 1

Practical/laboratory work gives the training to handle sophisticated apparatus and thus develops technical skills of handling instruments.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

All the questions in the questionnaire were prepared on the same lines and the teachers were asked to put a tick /✓/ in any of the five boxes as they deemed fit. This was followed by detailed instructions for filling up the questionnaire individually and a brief note on the practical/laboratory/field work.

Sample

The questionnaires were distributed among the various university/college teachers. The following eighty one questionnaires received from various disciplines are taken for purposes of analysis and design. The distribution of the questionnaire from the various disciplines is given as below:

S. No.	Name of the Subject	Number of Teachers
1	Zoology	11
2.	Botany	11
3.	Chemistry	15
4.	Physics	06
5.	Economics	07
6.	Psychology	05
7.	Commerce	04
8.	Home Science	05
9.	Miscellaneous	17
	Total	81

These teachers were drawn from different affiliated colleges and therefore represented a cross section of the teaching community. It was possible to consolidate their individual responses to every item and produce a consensus and give it back to them. These will be illustrated here.

Section I

This consists of a short note on 'Practical Examinations' in which details like definition of the practical examination, components of the practical examination like objectives, way of assessment, merits etc. are given briefly.

Section II

This is first a bio-data of the individual teacher where details like subject of specialization, subjects taught at both graduate/post-graduate levels, number of years of teaching experience and involvement in some form or other of any practical examinations are called for.

Section III

This is the important section of the questionnaire wherein a series of questions were given regarding the various aspects of the practical/laboratory/field work. Most of the questions of the questionnaire were given with a five point scale to receive the responses of the teachers. However, the questions of the part two of the same section were designed with a two point scale (two boxes). The first box of the same was designed to put a tick mark if the item exists and the second box was designed to give the weightage or rank order for that particular item. This section was divided into six major classes as given earlier. The responses for all the questions are analysed and the results are reported.

A. Scope and the nature of practical/laboratory/field work

Thirty four questions were included in this first part of the questionnaire. All the questions were related to the scope and the nature of practical/laboratory/field work. For the interpretation of the results, the skeleton of the question is given first and the percentage distribution of the responses later. This part A consists of 34 questions in all. Everyone of these is described below.

1. Practical/laboratory work gives the training to handle sophisticated apparatus and this develops technical skill in handling instruments.

The above statement has been'very much' agreed to by 39.50% of the respondent, 39.50 have 'agreed', 9.89% have 'felt uncertain', 11.11% have 'disagreed' and no body has 'very much' disagreed about it. Since more than 80% have very much agreed and agreed, the statement is highly applicable.

2. Practical/laboratory work involves basic knowledge regarding the functions of apparatus.

The above statement has been 'very much' agreed to by 38.27% of the respondents, 44.44% have 'agreed', 9.89% have 'felt uncertain', 5% have 'disagreed' and only 2.5% have 'very much' disagreed. Since more than 82% have agreed and very much agreed, this statement is highly acceptable.

3. Practical/laboratory work gives the basic knowledge to a student regarding the construction of the apparatus (leading to the preparation of improvised apparatus).

Only 18.51% have 'very much' agreed for this statement, 37.03% have 'agreed' 20.98% have 'felt uncertain', 22.25% have 'disagreed' and 1.23% have 'very much' disagreed. Since more than 55% have agreed and very much agreed to this statement, it also can be considered acceptable. It may well be that teachers think that some or most of them practical/laboratory/field work as it obtains now does not involve students in developing the ability to construct apparatus.

4. Practical/laboratory work gives the knowledge of trends and methodology of the exercise/experiment.

For this statement 24.69% have 'very much' agreed, 62.92 have 'agreed', 9.89% have 'felt uncertain', 2.50 have 'disagreed' but no one has 'very much' disagreed. More than 87% have agreed and very much agreed. So this statement is highly applicable.

5. The concept of "learning by doing" is inherent in practical/laboratory/field work.

This statement has been highly agreed to by 48.19% of the respondents 45.57% have agreed, 3.74% have felt uncertain and only 2.50 have disagreed. Since more than 93% have agreed and very much agreed for the same, it should be considered as a highly applicable statement.

6. Practical/laboratory/field work helps to demonstrate and reinforce the principles set out in theoretical lectures.

This statement has been very much agreed to by 45.67% of the respondents, 45.57% have agreed, 7.43 have felt uncertain and only 1.23% have disagreed. No one has very much disagreed. Since more than 91% have agreed and very much agreed with the same, it should also be considered highly applicable.

7. Practical/Laboratory/Field work enhances the theoretical knowledge and practical skills as both are complementary to each other.

This statement has been very much agreed to by 43.10% of the respondent, 51.85% have agreed, 3.72% have felt uncertain and only 1.23% have disagreed. No body has very much disagreed. Since more than 94% have agreed and very much agreed, this statement should be considered highly applicable.

8. Practical/laboratory/field work gives experience in operating and testing instruments.

This statement has been very much agreed to by 34.56% of the respondents, 43.20% have agreed, 13.58% have felt uncertain and only 8.66% have disagreed. Since more than 77% have agreed and very much agreed the statement is highly applicable.

9. The development of practical skills have been established as an important desirable outcome of teaching.

For this statement 34.56% have very much agreed, 45.67% have agreed 16.04 have felt uncertain and only 3.73% have disagreed. No one has very much disagreed

Since more than 80% have agreed and very much agreed to this statement it is to be considered as highly applicable.

10. Practical/laboratory/field work is carried out in a teaching course with the purpose of introducing, developing or reinforcing theoretical concepts.

For this statement 35.80% have fully agreed, 59.28% agreed, 2.52% felt uncertain and 2.40% disagreed, Since 95.08% have agreed and fully agreed for this statement, therefore, it should be considered as highly applicable.

11. Practical/laboratory/field work is often regarded as activities for doing rather than the knowing.

For this statement 32.22% have fully agreed, 29.62% agreed, 16.04% felt uncertain, 19.62% disagreed and 2.50 have fully disagreed. The analysis of the results for this item revealed that only 61% have agreed and fully agreed, so the same can be considered as highly applicable.

12. Practical/laboratory/field work involves the application of knowledge and the use of theoretical concepts.

For this statement 29.62% have very much agreed, 65.43 agreed 2.50% felt uncertain and only 2.50% disagreed, no one has very much disagreed. Since around 95% of the respondents have agreed and very much agreed, this can be considered as highly applicable.

13. Practical work given in the form of projects can also be designed to serve the same purpose. In addition (individual) projects help to bring out the problem solving skills of individuals; group projects in addition help students to work as a team (a very near life situation).

This statement has been very much agreed to by 35.80% of the respondent, 46.91% agreed, 13.58% felt uncertain and only 3.73 disagreed and no one has very much disagreed. Since more than 82% of the respondents have agreed and very much agreed, this statement can be considered highly applicable.

14. Practical/laboratory/field wo rk familarizes the students with the methods of collecting experimental/field data.

For this statement 37.03%, have very much agreed, 51.85% agreed, 9.87% felt uncertain and only 1.23% have disagreed. Since more than 88% have agreed and very much agreed, this statement can also be considered highly applicable.

15. Practical/laboratory/field work gives training in methods of analyses and interpretation of data.

This statement has been very much agreed to by 29.62% of the respondents, 55.55% agreed, 11.11 felt uncertain and only 3.70 disagreed. Since more than 85% have agreed and very much agreed and this statement is highly applicable.

16. Practical/laboratory/field work gives training for the preparation of scientific and technical report.

For this statement 32.09% have very much agreed, 49.38% agreed 3.70% felt uncertain, and 14.81% disagreed. No one has very much disagreed. Since more than 81% have agreed and very much agreed with this statement, it is also highly applicable.

17. Practical/laboratory/field work develops the ability to make a judgement and evaluate data and information.

For this statement 34.56% have very much agreed, 48.14% agreed, 12.34% felt uncertain and 4.95% disagreed, Since more than 82% have agreed and very much agreed, it is highly applicable.

18. In the practical/laboratory/field work, skills in handling instruments and use of them is learnt effectively by repetition.

With this statement 30.86% have very much agreed, 55.55% agreed, 11.11% felt uncertain and only 2.48% disagreed. Since more than 85% have agreed and very much agreed, it is highly applicable.

19. Practical/laboratory/field work leads to the development of ability and resourcefulness in planning and executing projects.

This statement has been very much agreed to by 19.75% of the respondents, 58.02% agreed, 11.11% felt uncertain, 9.87% disagreed and 1.23% have very much disagreed. More than 77% have agreed and very much agreed, so it should be considered as a highly acceptable statement.

20. In your subject area practical work is relevant.

With this statement 43.20% have very much agreed, 39.50% agreed, 8.66% felt uncertain, 7.40% disagreed and 1.23% have very much disagreed. Since more than 82% of the respondents have agreed and very much agreed with this statement, it should be considered highly applicable.

21. In your subject area practical work is already planned and available. This is of course inadequate.

With this statement 25.92% have very much agreed, 38.27% agreed, 22.22 felt uncertain, 12.34% disagreed and only 1.23% have very much disagreed. Since more than 63% of the respondents have agreed and very much agreed, this statement is also highly applicable.

22. In your subject area additional practical work can be planned.

With this statement 23.45% have very much agreed, 61.72% agreed, 13.58% felt uncertain and only 1.23% disagreed. Since more than 84% have agreed and very much agreed, it is also highly applicable.

23. The time allotted for practical work is sufficient.

With this statement only 14.81% have very much agreed, 38.27% agreed, 17.28% felt uncertain and 29.62% disagreed. Since only 52% of the respondents have agreed and vey much agreed, it may or may not be considered as an applicable statement.

24. Do you think that the skills to be learnt in practical work are to be demonstrated?

With this statement 22.22% have very much agreed, 43.20% agreed, 19.75% felt uncertain, 13.58% disagreed and only 1.23% have very much disagreed. Since more than 65% of the respondents have agreed and very much agreed, it is an applicable statement.

25. In your subject area laboratory work is relevant.

With this statement 24.69% have very much agreed, 44.44% agreed, 20.98% felt uncertain, 8.64% disagreed and only 1.23% have very much disagreed. More than 69% of the respondents have agreed and very much agreed, so it is highly applicable.

26. In your subject area laboratory work is planned and available. This is of course inadequate.

With this statement 17.28% of the respondents have very much agreed, 46.91% agreed, 28.39% felt uncertain, 6.17% disagreed and only 1.23% have very much disagreed. More than 64% of the respondents have agreed and very much agreed, so the statement is highly applicable.

27. In your subject area additional laboratory work can be planned to develop skills of handling instruments, manipulating, recording and to infer and write a report and so on.

With this statement 20.98% of the respondents have very much agreed, 58.02% agreed, 18.55% felt uncertain, 1.23% disagreed and only 1.23% very much disagreed. It shows that more than 78% of the respondents agreed and much agreed, so this is highly applicable.

28. The time allotted for laboratory work is sufficient.

With this statement only 8.64% have very much agreed 49.38% agreed, 40.7% felt uncertain and only 1.23% disagreed. Since only 57% of the respondents agreed and very much agreed for this, it may also be considered as an applicable statement.

29. Do you think that the skills to be learnt in the laboratory is to be demonstrated ?

With this statement 18.51% of the respondents have very much agreed and 43.20% agreed, 23.45% felt uncertain, 12.34% disagreed and only 2.46% very much disagreed. Since more than 61% of the respondents have agreed and very much agreed, the item is highly applicable.

30. In your subject area field work is relevant.

With this statement only 19.75% of the respondents have very much agreed, 32.09% agreed, 38.27% felt uncertain, 9.87% disagreed and none has very much disagreed. Since only 51% of the respondents have agreed and very much agreed the statement requires some sort of further consultation for its applicability.

31. In your subject area, already field work is planned and available. This is of course inadequate.

With this statement only 12.34% of the respondents have very much agreed and 20.98% agreed, 45.67% felt uncertain and 20.98% have disagreed. It is therefore quite obvious that the statement is not at all applicable and requires further improvement since only 33% have agreed and very much agreed.

32. In your subject area field work can be planned.

With this statement 20.98% of the respondents have very much agreed, 33.33% agreed, 44.44% felt uncertain and only 1.23% disagreed. Since more than 54% of the respondents have agreed and very much agreed for this statement, it may or may not be considered applicable.

33. The time allotted for the field work to collect relevant data and information is sufficient.

With this statement only 4.93% of the respondents have very much agreed, 8.64% agreed, 59.25% felt uncertain, 24.69% disagreed and only 2.46% very much disagreed. Since only 13% of the respondents have agreed and very much agreed, it is quite obvious that the statement cannot be considered applicable and therefore it is concluded that the time required is more than what is provided.

34. Do you think that the skill to be learnt is to be demonstrated in field work?

With this statement only 14.81% of the respondents have very much agreed, 23.45% agreed, 56.79% felt uncertain and only 4.93% disagreed. Since only 38% of the respondents have agreed and very much agreed for this statement, it is quite obvious that it can not be considered an applicable statement and it requires further improvement.

SUMMARY OF THE RESULTS OF SECTION A

The consensus obtained for the statements of this first part of the questionnaire regarding the scope and nature of practical/laboratory/field work reveals that as many as twenty seven statements, out of thirty four, have been found highly applicable. The list of these statements is given below:

1. Practical/laboratory work gives the training to handle sophisticated apparatus and thus develops technical skills of handling instruments.
2. Practial/laboratory work involves basic knowledge regarding the functions of apparatus.
3. Practial/laboratory work gives the basic knowledge to a student regarding the construction of the apparatus.

(leading to preparation of improvised apparatus).

4. Practical/laboratory work gives the knowledge of trends and methodology of the exercise/experiment.

5. The concept of 'learning by doing' is inherent in practical/laboratory/field work.

6. Practical/laboratory/field work helps to demonstrate and reinforce the principles set out in theoretical lectures.

7. Practical/laboratory/field work enhances the theoretical knowledge and practical skill as both are complementary to each other.

8. Practical/laboratory/field work gives experience in operating and testing instruments.

9. The development of practical skills has been established as an important desirable outcome of teaching.

10. Practical/laboratory/field work is carried out in a teaching course with the purpose of introducing, developing or reinforcing theoretical cóncepts.

11. Practical/laboratory/field work is often regarded as activities for doing rather than the knowing.

12. Practical/laboratory/field work involves the application of knowledge and the use of theoretical concepts.

13. Practical work given in the form of projects can also be designed to serve the same purpose. In addition (individual) projects help to bring out the problem solving skills of individuals; group projects in addition help students to work as a team (a very near- life situation).

14. Practial/laboratory/field work familiarizes the students with the methods of collecting experimental/field data.

15. Practical/laboratory/field work gives training in methods of analyses and interpretation of data.

16. Practical/laboratory/field work gives the training for the preparation of scientific and technical report.

17. Practical/laboratory/field work develops the ability to make a judgement and evaluate data and information.

18. In the practical/laboratory/field work, skill in handling instruments and use of them is learnt effectively by repetition.

19. Practical/laboratory/field work leads to the development of the ability and resourcefulness in planning and executing projects.

20. Practical work is relevant.

21. Already practical work is planned and available. This is of course inadequate.

22. Additional practical work can be planned

23. That the skill to be learnt in practical work is to be demonstrated.

24. Laboratory work is relevant.

25. Laboratory work is planned and available. This is of course inadequate.

26. Additional laboratory work can be planned to develop skills of handling instruments, manipulating, recording and to infer and write a report and so on.

27. That the skill to be learnt in the laboratory is to be demonstrated

Frequency of the responses in a tabular form:

Summary of the results showing the various distribution of the responses:

To have a quick glance through the results of the first part of the questionnaire a separate table with various distribution of percentages is given below. As twenty seven statements out of thirty-four have been found highly applicable and all of them are listed earlier, so in this table simply the statement number is given along with the percentages of agreements.

Statement No.	Very much agree %	Agree %	Felt uncertain %	Disagree %	Very much disagree %
1.	39.50	39.50	9.89	11.11	-
2.	38.27	44.44	9.89	5.00	2.5
3.	18.51	37.03	20.98	22.25	1.23
4.	24.69	62.92	9.89	2.50	-
5.	48.19	45.57	8.74	2.50	-
6.	45.67	45.57	7.43	1.23	-
7.	43.10	51.85	3.72	1.23	-
8.	34.56	43.20	13.58	8.66	-
9.	34.56	45.67	16.04	3.73	-
10.	35.80	59.28	2.52	2.40	-
11.	32.22	29.62	16.04	19.62	2.50
12.	29.62	65.43	2.50	2.50	-
13.	35.80	46.91	13.58	3.73	-
14.	37.03	51.85	9.87	1.23	-
15.	29.62	55.55	11.11	3.70	-
16.	32.09	49.38	3.70	14.81	-
17.	34.56	48.14	12.34	4.95	-
18.	30.86	55.55	11.11	2.48	-
19.	19.75	58.02	11.11	9.87	1.23
20.	43.20	39.50	8.65	7.40	1.23
21.	25.92	38.27	22.22	12.34	1.23
22.	23.45	61.72	13.58	1.23	-
23.	22.22	43.20	19.75	13.58	1.23
24.	24.69	44.44	20.98	8.64	1.23
25.	17.28	46.91	28.39	6.17	1.23
26.	20.98	58.02	18.55	1.23	1.23
27.	18.51	43.20	23.45	12.34	2.46

Table No. 1

Correlation Values For the Items Of Section – 'A'

As the respondents were classified into nine groups on the basis of their subjects, the correlation values (item-wise) for all the subjects were calculated and given below:

Item No.	Zoology	Botany	Chemistry	Physics	Economics	Psychology	Commerce	Home Science	General Subjects	Total
1.	–	.312	.136	.138	.000	.996	.982	.737	–.058	.207
2.	–.667	–.374	.250	–.131	.981	.996	.982	.404	–.017	.588
3.	.067	.708	–.521	.744	.945	.996	.982	.771	.291	.605
4.	.205	.415	–.115	.305	.974	.799	.982	.614	–.185	.648
5.	.338	.387	–	–.131	.994	.718	.421	.704	.041	.436
6.	.306	–	.513	.781	.981	.308	.767	.000	.243	.886
7.	–	.400	.263	.781	.981	.718	.982	.844	.195	–
8.	.580	.712	.357	.744	.945	.742	.982	.969	.407	.713
9.	.763	.627	–.412	.473	.915	.812	.982	.451	.108	.391
10	.676	.712	–	.131	.939	.718	–.421	.623	.012	.372
11.	.002	.376	.353	–	.829	.836	–.421	.541	.265	.163
12.	.502	.648	.566	.611	.982	.718	.904	.000	.360	.000
13.	.565	.443	–.747	.944	.958	.973	.982	.294	.034	.346
14.	.845	–.388	.043	.611	.916	.126	.495	.623	.132	.264
15.	–	.750	–.129	.733	.945	.126	.495	.746	.244	.178
16.	.721	.661	.669	.830	.932	.718	.495	.834	.101	.174
17.	.084	.525	.222	.000	.979	.970	.618	.569	.177	.402
18	[illegible]	.512	.000	.131	.957	.996	.982	.000	.079	.695
19.	.764	.341	.254	.620	.974	.718	.982	.771	.139	.381
20.	.454	.482	.974	.380	.961	.815	.130	.119	.105	.555
21.	.683	.535	.297	–	.611	.598	.982	.917	.102	.650
22.	.845	.720	.207	.000	.661	.725	–	.629	.182	.625
23.	.129	.490	–.071	.830	.483	.814	–	.303	.144	.500
24.	.666	.562	.176	–.414	.411	.953	–	.819	–.025	.582
25.	–.209	.284	.522	–.830	–	.996	–	.629	.676	.551
26.	.589	.733	.550	.090	–	.802	–	–.710	.579	.555
27	–	.131	.433	.611	–	.827	–	–.844	–	.000
28	.299	.939	.271	.830	–	.713	–	.303	.709	.538
29	–	.779	.308	.000	–	.825	–	.909	–	.391
30	–	.601	.524	.567	.973	.718	.982	–	.730	.168
31	–	.103	.505	.698	.710	–	.479	.334	.621	.912
32.	–	.651	.953	.680	–.128	.323	.982	–.334	.769	.306
33.	–	.190	.550	.611	–.611	.878	.537	–.334	.515	.203
34.	–	.746	.425	.611	–.266	–.703	.000	–.334	.672	.265

B. Objectives of practical/laboratory/field work.

Twenty six questions were included in this second part of the questionnaire. All the questions/statements were related to the objectives of practical/laboratory/field work. Against every statement there were six boxes - two for practical work, two for laboratory work and two for field work. Teachers were asked to make a tick mark against every statement in the first box if that applies to their discipline of practical/laboratory/field work and, in the second box to give a rank order for all the selected statements with the actual number written in the second box. The following are the objectives of practical/laboratory/field work. Various rank orders for practical/laboratory/field work for a single objective as given by the teachers are as follows.

1. Investigation of theoretical principles and concepts, and their applications.

	Practical work (PW)	Laboratory work (LW)	Field work (FW)
Rank order	7	16	10

Here the rank order for the above mentioned objective given by the teachers is seven for practical work, sixteen for laboratory work and ten for field work.

2. Appreciation of measurements and measurement techniques.

	(PW)	(LW)	(FW)
Rank order	6	20	6

3. To demonstrate a basic law and to verify the correctness of theoretical calculations.

	(PW)	(LW)	(FW)
Rank order	3	18	5

4. Appreciation of instruments and equipment design.

	(PW)	(LW)	(FW)
Rank order	8	17	3

5. Appreciation of experimental technique i. e. stipulation of a problem and the devising of best means and procedures for economic solution.

	(PW)	(LW)	(FW)
Rank order	2	8	8

6. To establish a mathematical relationship between variables.

	(PW)	(LW)	(FW)
Rank order	5	2	7

7. To teach the use of certain machines

	(PW)	(LW)	(FW)
Rank order	7	9	2

8. Development of individual and group discussion abilities

	(PW)	(LW)	(FW)
Rank order	10	10	12

9. To teach the use of certain machines and the way to test a machine.

	(PW)	(LW)	(FW)
Rank order	4	13	1

10. Development of visual communication, sketching of apparatus and graphs etc.

	(PW)	(LW)	(FW)
Rank order	16	24	9

11. Development of techniques of recording and reporting

	(PW)	(LW)	(FW)
Rank order	14	5	14

12. Development of team techniques working as a team

	(PW)	(LW)	(FW)
Rank order	14	21	19

13. Development of ability to follow instructions

	(PW)	(LW)	(FW)
Rank order	12	6	15

14. To develop the insight in planning and executing projects

	(PW)	(LW)	(FW)
Rank order	1	1	17

15. Development of the basic knowledge regarding the construction of the apparatus (leading to preparation of improvised apparatus)

	(PW)	(LW)	(FW)
Rank order	9	7	4

16. To demonstrate and reinforce the principles set out in theoretical lectures.

	(PW)	(LW)	(FW)
Rank order	20	11	11

17. To enhance the theoretical knowledge and practical skill as both are complementary to each other.

	(PW)	(LW)	(FW)
Rank order	17	15	11

18. Development of the activities for doing rather than knowing (a concept of learning by doing)

	(PW)	(LW)	(FW)
Rank order	19	7	18

19. Practical/laboratory/field work involves the application of knowledge and the use of theoretical concepts

	(PW)	(LW)	(FW)
Rank order	21	15	20

20. Individual projects help to bring out the problems solving skills of individuals, whereas group projects help to work as a team.

	(PW)	(LW)	(FW)
Rank order	13	4	23

21. To develop the insight for collecting, analysing and interpreting the date.

	(PW)	(LW)	(FW)
Rank order	18	23	21

22 Development of the abilities to make a judgement and

evaluate data and information.

	(PW)	(LW)	(FW)
Bank order	15	3	22

23. Development of the ability and resourcefulness for the preparation of scientific and technical reports.

	(PW)	(LW)	(FW)
Rank order	22	12	13

24. Development of the level of knowledge of units, limitations of instruments, and ways and means of using apparatus and instruments.

	(PW)	(LW)	(FW)
Rank order	11	22	7

25 Developmwnt of the ability to draw conclusions and inferences.

	(PW)	(LW)	(FW)
Rank order	24	19	16

26. Development of the ability to produce or reproduce the knowledge which a student has acquired by reading the books.

	(PW)	(LW)	(FW)
Rank order	23	14	24

SUMMARY LISTING THE OBJECTIVES IN THE FINAL RANK ORDER

The consensus obtained for all the twenty six statements of this section with their rank order is summarized below:

Statement No.	Rank order for Practical work	Rank order for Laboratory work	Rank order for Field work
1	7	16	10
2.	6	20	6
3.	3	18	5
4.	8	17	3
5.	2	8	8
6.	5	2	7
7.	7	9	2
8.	10	10	12
9.	4	13	1
10.	16	24	9
11.	14	5	14
12.	14	21	19
13.	12	6	15
14.	1	1	7
15.	9	7	4
16	20	11	11
17.	17	15	11
18.	19	7	18
19.	21	15	20
20	13	4	23
21.	18	23	21
22.	15	3	22
23.	22	12	13
24	11	22	7
25	24	19	16
26	23	14	24

C. Assessment methods for practical/laboratory/field work

Twenty three questions were included in this third section of the questionnaire. All the questions were related to the assessment methods for practical/laboratory/field work. Teachers were asked to respond to all the twenty three questions on a five point scale. The results for all the questions were analysed and are given below according to their serial number.

1. The present modes of assessment of practical/laboratory/field work are inefficient and being traditional there is no innovation in them.

   With this statement 35.82% of the respondents have very much agreed, 45.67% agreed, 8.64% felt uncertain, 7.40% disagreed and only 2.46% have very much disagreed. Since more than 81% of the respondents have agreed and very much agreed, this statement is highly applicable.

2. Since we use the same experiments for practical/laboratory/field work year after year, there is a tendency among students to borrow the practical/laboratory/field work from the note books of students of earlier years.

   This statement has been very much agreed by 48.14% of the respondents, 39.50% agreed, 6.17% felt uncertain, 4.93% disagreed and only 1.23% have very much disagreed. Since more than 87% of the respondents have agreed and very much agreed this statement is also highly applicable.

3. The assessment procedure for practical/laboratory/field work is very much biased. The students having good rapport with their teachers secure better marks/grades.

   With this statement only 18.51% of the respondents have very much agreed, 40.74% agreed, 17.28% felt uncertain, 20.98% disagreed and only 2.46% have very much disagreed. Since more than 59% of the respondents have agreed and very much agreed with this statement, it may be considered an applicable statement.

4. An end practical/laboratory/field work examination (at the

end of a year or semester) suffers from poor content validity.

With this statement only 13.58% of the respondents have very much agreed 37.03% agreed, 38.27% felt uncertain and only 11.11% have disagreed. No one has very much disagreed. Since 50% of the respondents have agreed and very much agreed with this statement, it may or may not be considered applicable or this may be included after further consultation.

5. In the final practical/laboratory examination, there is a 'chance factor' in that a student has to pick out a random experiment/practical for the examination. It may well happen that a student may land up with the one that he has not performed.

With this statement 25.92% have very much agreed, 44.44% agreed, 17.28% felt uncertain, 11.11% disagreed and only 1.23% have very much disagreed. Since more than 70% of the respondents have agreed and very much agreed, the statement is highly applicable.

6. Since a large number of students are examined in a limited time it becomes a problem for the examiners to make a real assessment of their abilities.

With this statement 30.86% of the respondents have very much agreed 39.50% agreed, 19.75% felt uncertain, 8.64% disagreed and only 1.23% have very much disagreed. Since more than 70% of the respondents have agreed and very much agreed this statement may also be considered as highly applicable.

7. Since the end practical/laboratory examinations are conducted in different batches and a fixed number of laboratory test questions are repeated for every batch with a minor variation of data, the content validity is very low.

With this statement 32.09% of the respondents have very much agreed 40.74% agreed, 12.34% felt uncertain and 14.81% disagreed. Since more than 72% of the respondents have agreed and very much agreed, the statement is highly applicable.

8. During the time the students are busy with their experimental work, the examiners go around for examining each student orally and thus divert their attention.

With this statement only 12. 34% of the respondents have very much agreed, 38.27% agreed, 20.98% felt uncertain, 27.16% disagreed and only 1.23% very much disagreed. Since only 50% of the respondents have agreed and very much agreed with this statement, it requires some improvement for its applicability.

9. Examiners generally ask a few questions unrelated to the experiment/ practical work undertaken by the examinee at the examination which may not be answered by the students and the assessment is usually based on the number of correct answers given by the students.

With this statement only 7.40% of the respondents have very much agreed, 35.82% agreed, 16.04% felt uncertain, 38.27% disagreed and 2.46% very much disagreed. Since only 43% of the respondents have agreed and very much agreed with this statement, the statement is not highly applicable. It requires further improvement for its applicability.

10. In a few institutions, due to lack of adequate laboratory facilities the candidates are not required to carry out any practicals and the assessment is made on the basis of the relationship between the teacher and the students.

With this statement only 19. 75% of the respondents have very much agreed, 22.22% agreed, 44.44% felt uncertain, 22.22% disagreed and only 3.70% very much disagreed. Since only 41% of the respondents have agreed and very much agreed with this statement, it is not highly applicable.

11. During the oral testing in the practial/laboratory examinations the examiners generally ask the same question to every student.

With this statement only 6.17% of the respondents very much agreed, 18.51% agreed, 30.86% felt uncertain, 41.97%

disagreed and 2.46% have very much disagreed. Since only 24% of the respondents have agreed and very much agreed with this statement, it is not at all applicable.

12. In the present day practical/laboratory examinations the scores do not cover a wide range e.g. the range of marks is usually between 60% to 90% and thus it becomes difficult to discriminate between good and poor students.

    With this statement 19.75% of the respondents have very much agreed, 43.20% agreed, 14.01% felt uncertain and 23.04% disagreed. No one has very much disagreed. Since more than 62% of the respondents have agreed and very much agreed with this statement, it is highly applicable.

13. Some times it happens that during the practical/laboratory examination a student has to perform an experiment which he had missed during the academic year due to some unavoidable circumstances and thus becomes helpless at the examination. The content validity of the end practical/laboratory examination suffers on account of this.

    With this statement 12.34% of the respondents have very much agreed, 48.14% agreed, 14.81% felt uncertain and 24.68% disagreed. Since more than 60% of the respondents have agreed and very much agreed with this statement, this is also highly applicable.

14. In practicals generally the results of the experiments/practicals are to some extent known to students so that the ability of application in a practical situation is never tested

    With this statement only 13.58% have very much agreed 33.33% agreed, 22.22% felt uncertain and 30.86% have disagreed. Since only 47% of the respondents have agreed and very much agreed with this statement, it is not at all applicable.

15. In certain practical experiments some students have already been told by the teachers regarding the questions (e.g. dissection of animals and the parts to be mounted) so that students come prepared (carry these parts to the laboratory/

examination hall) and get undue credit.

With this statement only 16.04% of the respondents have very much agreed, 22.22% agreed, 24.68% felt uncertain, 29.62% disagreed and 7.40% very much disagreed. Since only 38% of the respondents have agreed and very much agreed, the statement is not at all applicable.

16. There is no option for the students to select the experiments in the practical/laboratory examination and they are supposed to do the given experiment only. This procedure not only lacks content validity but has a "chance factor".

With this statement 20.98% of the respondents have very much agreed 51.85% agreed, 14.81% felt uncertain, 11.11% disagreed and only 1.23% very much disagreed. Since more than 72% the respondents have agreed and very much agreed with this statement, it is highly applicable.

17. In the practical/laboratory examination the assessment is made on the opinion of the external and internal examiners. But it is the general practice that the marks are decided by the internal examiner and therefore favouritism is likely to be shown by the internal.

With this statement only 17.28% have very much agreed, 25.92% agreed, 30.86% felt uncertain, 24.69% disagreed and only 1.23% very much disagreed. Since only 43% of the respondents have agreed and very much disagreed with this statement, it is not at all applicable.

18. The practical/laboratory work can be assessed with the help of set exercises/experiments/field work.

With this statement 22.22% of the respondents have very much agreed, 50.61% agreed, 22.22% felt uncertain and only 4.93% disagreed. Since more than 72% have agreed and very much agreed, the statement is also highly applicable.

19. The practical/laboratory/field work can be assessed through project work.

With this statement only 9. 86% of the respondents have very much agreed, 33. 33% agreed, 39. 50% felt uncertain, 16. 04% disagreed and 1. 23% very much disagreed. Since only 43% have agreed and very much agreed with this statement, it is not at all applicable.

20. The practial/laboratory/field work can be assessed by measuring certain agreed qualities of performance over the whole of the course followed by the student.

With this statement 30.86% of the respondents have very much agreed, 41. 97% agreed, 18. 51% felt uncertain and only 8. 64 disagreed. Since more than 72% of the respondents have agreed and very much agreed with this statement, it is highly applicable.

21. The practical/laboratory/field work can be assessed on the basis of the practical note books, home work and class work records.

With this statement only 14. 81% of the respondents have very much agreed, 32. 09% agreed, 18. 51% felt uncertain and 34. 56% disagreed. Since only 46% have agreed and very much agreed with this statement, it is not at all applicable.

22. The practical/laboratory work can be assessed by oral questioning.

With this statement only 7. 40% of the respondents have very much agreed, 44. 44% agreed, 18. 51% felt uncertain, 29. 62% disagreed. Since only 51% of the respondents have agreed and very much agreed with this statement, it may require some improvement for its applicability.

23. Practical/laboratory work can be assessed by the examiners's personal impressions during the normal conduct of laboratory work.

With this statement only 7. 40% of the respondents have very much agreed, 35. 80% agreed, 19. 75% felt uncertain, 30.86% disagreed and only 6.17% very much disagreed with this statement, it is not applicable.

SUMMARY OF THE RESULTS OF SECTION 'C'

The consensus obtained for the statements of this section of the questionnaire regarding the assessment methods for practical/laboratory/field work reveals that as many as eleven statements have been accepted as highly applicable. The list of these statements is given below.

1. The present modes of the assessment of practical/ laboratory/field work are inefficient and traditional and therefore lack innovation.

2. Since we use the same experiments for the practical/ laboratory/field work year after year, there is a tendency among students to borrow the practical/laboratory/field work note books form students of earlier years.

3. The assessment procedure for practical/laboratory/field work is very much biased. The students having good rapport with their teachers secure better marks/grades.

4. In the final practical/laboratory examination, there is a 'chance factor' in that a student has to pick out a number of an experiment/practical for the examination. It may well happen that a student may land up with the one that he had not performed.

5. Since a large number of students are examined in a limited time it becomes a problem for the examiners to make a real assessment of their abilities.

6. Since the end practical/laboratory examinations are conducted in different batches and a fixed number of laboratory test questions are repeated for every batch with a minor variation of data, the content validity is very low as a result.

7. In the present day practical/laboratory examinations the

scores do not cover a wide range e.g. the range of marks is usually between 60% to 90% and thus it becomes difficult to discriminate between good and poor students.

8. Many times it happens that during the practical/laboratory examination a student has to do an experiment which he missed during the academic year due to some unavoidable circumstances and thus becomes helpless at time. The content validity of the end practical/laboratory examination suffers on account of this.

9. Since there is no option for the students to select the experiments in the practical/laboratory examination and the student is supposed to do the given experiment only, this procedure not only lacks content validity but depends on "Chance factor".

10. The practical/laboratory work can be assessed by the help of set exercises/experiments/field work.

11. The practical/laboratory/field work can be assessed by measuring certain agreed qualities over the whole of the course followed

Frequency of the responses in a tabular form

Summary of the results showing the various distribution of the responses:

To have a quick glance through the results of the third part of the questionnaire, a separate table with various distribution of percentage is given below. As eleven statements, out of twenty three have been found highly applicable and all of them are listed earlier, so in this table simply the statement number for all the accepted items is given along with the percentages of agreements.

Statement No.	Very much agree %	Agree %	Uncertain %	Disagree %	Very much disagree%
1.	35.82	45.67	8.64	7.40	2.46
2.	48.14	39.52	6.17	4.93	1.23

Correlation Values For the Items of Section 'C'

As the respondents were classified into nine groups on the basis of their subjects, the correlation values (item-wise) for all the subjects were calculated and given below

Item No.	Zoology	Botany	Chemistry	Physics	Economics	Psychology	Commerce	Home Science	General Subjects	Total
1.	.221	.404	.522	.321	-.467	.859	.983	.565	.518	.600
2.	.783	.063	.544	.367	-.301	.659	.908	.919	.641	.493
3.	.141	.335	.274	.390	-.256	.547	.902	.919	.822	.407
4.	.634	.746	.104	.094	.631	.659	.975	.650	.814	.558
5.	.618	.513	.151	.413	.427	.801	-	.845	.728	.720
6.	.671	.418	.631	.865	1.000	.820	.431	.896	.809	.819
7.	.581	.664	.574	.367	.967	.941	-	.920	.604	.844
8.	-.011	.589	.503	.120	.981	.941	.431	.532	.590	.735
9.	.930	.414	.561	.000	.928	.941	-	.242	.670	.677
10.	.657	.685	.681	.602	.831	.881	-	.811	.919	.923
11.	.517	.406	.699	.696	.908	.795	.733	.139	.671	.698
12.	.608	.105	.647	.688	.957	.900	-	.563	.615	.784
13.	.612	.238	.609	.605	.960	.941	-	.463	.688	.802
14.	.892	.620	.651	.406	.986	.944	-	.896	.787	.823
15.	.483	.653	.714	.843	.850	.914	-	.532	.568	.748
16.	.435	.100	.751	.648	.964	.941	-	.000	.708	.797
17.	.366	.722	.685	.413	.991	.914	-	.564	.712	.809
18.	.194	-.435	.392	.000	.860	.941	-	.565	.695	.810
19.	-.380	-.011	-.176	.696	.746	.900	.975	-	.730	.447
20.	-.380	.078	-.357	.550	.800	.900	.959	-.574	.764	.548
21.	-.635	.147	-.079	.000	.613	.516	.766	.820	.574	.400
22.	-.495	.018	-.242	-.519	.961	.752	.766	.432	.427	.533
23.	-.139	.747	-.080	.091	.966	.917	.802	-	.597	.674

3.	18.53	40.74	17.28	20.98	2.46
4.	25.93	44.44	17.28	11.11	1.23
5.	30.86	39.50	19.76	8.64	1.23
6.	32.09	40.74	12.34	14.82	-
7.	19.75	43.20	14.81	23.04	-
8.	12.34	48.14	14.81	24.70	-
9.	20.98	51.85	14.82	11.11	1.23
10.	22.22	50.61	22.22	4.94	-
11.	30.86	41.98	18.51	8.64	-

D. End external examination and continuous assessments

In this fourth section of the questionnaire seventeen questions were included. All the questions were related to the end external examination and continuous assessment as the practical/laboratory/field work may be assessed either externally or internally. Teachers were asked to respond on a five point scale. Analysis of their responses and the interpretations of the results for the same are given as follows:

1. External assessment provides an independent assess whose results are most likely to be accepted by the of examination results.

   With this statement only 9.86% of the respondents have very much agreed, 54.32% agreed, 18.51% felt uncertain, 16.04% disagreed and only 1.23% very much disagreed. Since more than 64% of the respondents have agreed and very much agreed, the statement is highly applicable.

2. External assessment provides for uniformity of practice and standards with all students being assessed upon common qualities by common criteria.

   With this statement 17.28% of the respondents have very much agreed, 49.38% agreed, 17.28% felt uncertain, 14.81

disagreed and 1.23% very much disagreed. Since more than 66% of the respondents have agreed and very much agreed the statement is highly applicable.

3. External assessment concentrates resources and expertise for setting and marking.

With this statement only 8.64% of the respondents have very much agreed, 34.56% agreed, 32.09% felt uncertain, and 24.69% disagreed. Since only 43% of the respondents have agreed and very much agreed, this statement is not applicable.

4. External assessment obviates the possibility of any conflict arising between the teacher as a teacher and the teacher as an assessor.

With this statement only 9.87% of the respondents have very much agreed, 50.61% agreed, 17.28% felt uncertain and only 22.22% disagreed. Since more than 60% of the respondents have agreed and very much agreed, the statement is highly applicable.

5. External assessment provides an assessment procedure unaffected by personal relationship between teacher and students.

With this statement 20.98% of the respondents have very much agreed, 55.55% agreed, 13.58% felt uncertain and only 9.87% disagreed. Since more than 76% of the respondents have agreed and very much agreed, it is highly applicable.

6. The means of external assessment are limited to those which can be administered by an external agency.

With this statement only 9.87% of the respondents have very much agreed, 45.67% agreed, 19.75% felt uncertain and 24.69% disagreed. Since 55% of the respondents have agreed and very much agreed, it requires some more consultation for its applicability.

7. The external assessment may exercise a restricting in-

fluence upon the practical/laboratory work carried out in institutions/colleges.

With this statement only 9.87% of the respondents have very much agreed, 40.74% agreed, 23.45% felt uncertain, 24.69% disagreed and only 1.23% very much disagreed. Since only 50% of the respondents have agreed and very much agreed, it is not at all highly applicable.

8. The external assessment is limited to the outcomes of practical work and does not include a consideration of how the work is carried out.

With this statement only 14.81% of the respondents have very much agreed, 39.50% agreed, 32.09% felt uncertain, 12.34% disagreed and only 1.23% very much disagreed. Since only 54% of the respondents have agreed and very much agreed, the statement is not highly applicable.

9. The number of occasions upon which the external assessment can take place is limited for administrative reasons.

With this statement 16.04% of the respondents have very much agreed, 60.49% agreed, 18.51% felt uncertain and only 4.93% disagreed. Since more than 76% of the respondents have agreed and very much agreed, it is highly applicable.

10. In the practical/laboratory work, the danger of chance failure or success in the internal assessment are decreased by making assessment possible on a number of occasions.

With this statement 14.81% of the respondents have very much agreed, 64.19% agreed, 14.81% felt uncertain and only 6.17% disagreed. Since 79% of the respondents have agreed and very much agreed,the statement is highly applicable.

11. During the internal assessment of practical/laboratory work, a wide variety of means of assessment may be used

covering a wide variety of qualities.

With this statement 22.22% of the respondents have much agreed, 55.55% agreed, 19.75% felt uncertain and only 2.46% disagreed. Since more than 77% of the respondents have agreed and very much agreed, the statement is highly applicable.

12. Internal assessment of the practical/laboratory work requires teachers to think about assessment in terms of educational and assessment objectives.

With this statement 20.98% of the respondents have very much agreed, 59.25% agreed, 16.04% felt uncertain and only 3.70% disagreed. Since more than 80% of the respondents have agreed and very much agreed with this statement, the statement is highly applicable.

13. Internal assessment of the practical/laboratory work enables students to be assessed on how they undertake practical work as well as on its outcomes.

With this statement 18.51% of the respondents have very much agreed, 61.72% agreed, 17.28% felt uncertain and only 2.46% disagreed. Since more than 80% of the respondents have agreed and very much agreed, the statement is highly applicable.

14. Internal assessment in the practical/laboratory work is likely to be more objective than external assessment.

With this statement 23.45% of the respondents have very much agreed, 43.20% agreed, 20.98% felt uncertain and only 12.34% disagreed. Since more than 66% of the respondents have agreed and very much agreed with this statement, it is highly applicable.

15. Internal assessment in the practical/laboratory work can some times endanger the relationship between teacher and student.

With this statement 20.90% of the respondents have very much agreed, 48.14% agreed, 16.04% felt uncertain and 14.81% disagreed. Since more than 69% of the respondents have agreed and very much agreed with this statement, it is highly applicable.

16. Internal assessment in the practical/laboratory/field work makes it difficult to relate and compare standards between institutions/colleges.

    With this statement 22.22% of the respondents have very much agreed, 44.44% agreed, 17.28% felt uncertain and only 16.04% disagreed. Since more than 66% of the respondents have agreed and very much agreed, it is also applicable

17. Internal assessment in the practical/laboratory/field work can give rise to suspicions in the minds of users about the validity and reliability of the results of the assessment.

    With this statement 18.51% of the respondents have very much agreed, 44.44% agreed, 22.22% felt uncertain, 12.34% disagreed and only 2.46% very much disagreed. Since more than 62% of the respondents have agreed and very much agreed with this statement, it is also applicable.

SUMMARY OF THE RESULTS OF SECTION 'D'

The consensus obtained for the statements of this section of the questionnaire regarding the end external examination and continuous assessment reveals that as many as thirteen statements out of seventeen have been found highly acceptable. The list of all these accepted statements is given below:

1. External assessment provides an independent assessment whose results are most likely to be accepted by the users of examination results.

2. External assessment provides for uniformity of practice and standards with all students being assessed upon common qualities by common criteria.

3. External assessment obviates the possibility of any con-

flict arising between the teacher as a teacher and the teacher as an assessor.

4. External assessment provides an assessment procedure unaffected by personal relationship between teacher and student.

5. The number of occasions upon which the external assessment can take place is limited for administrative reasons

6. In the Practical/Laboratory work, the danger of chance failure or success in the internal assessment are decreased by making assessment possible on a number of occasions.

7. During the internal assessment of practical/laboratory work a wide variety of means of assessment may be used covering a wide varieties of qualities.

8. Internal assessment of the practical/laboratory work requires teachers to think about assessment in terms of educational and assessment objectives.

9. Internal assessment of the practical/laboratory work enables students to be assessed on how they undertake practical work as well as on its outcomes.

10. Internal assessment in the practical/laboratory work is likely to be more objective than external assessment.

11. Internal assessment in the practical/laboratory work can some times endanger the relationship between teacher and student.

12. Internal assessment in the practical/laboratory/field work makes it difficult to relate and compare standards between institutions/colleges.

13. Internal assessment in the practical/laboratory/field work can give rise to suspicions in the minds of users about the validity and reliability of the results of the assessment.

Table No. 3

Correlation Values For the Items of Section -'D'

As the respondents were classified into nine groups on the basis of their subjects, the correlation values (item-wise) for all the subjects were calculated and given below:

Item No.	Zoology	Botany	Chemistry	Physics	Economics	Psychology	Commerce	Home Science	General subjects	Total
1	.390	.313	.542	.451	.807	.929	-.787	.954	.445	.699
2	.380	.288	.086	.451	.745	.890	-.787	.966	.467	.578
3.	.802	.244	.304	.143	.729	.655	.679	.910	.355	.615
4.	.319	.592	.727	.264	.902	.905	.000	.833	.685	.666
5	.738	-.069	.206	.000	.744	.997	-.832	.653	.642	.468
6.	.556	.329	.634	.509	.777	.857	.000	.939	.431	.639
7.	.629	.625	.487	.539	.772	.888	.572	.833	.235	.627
8.	.435	.650	.574	.474	.622	.601	.345	.982	.762	.615
9.	.869	.793	.512	.041	.704	.684	-.754	.982	.809	.720
10.	.533	.539	.821	.610	.711	.684	-.565	.972	.700	.715
11.	.735	.669	.628	.000	.784	.978	-.483	.996	.427	.742
12.	.799	.327	.570	.424	.834	.978	-.483	.989	.373	.768
13.	.799	.257	.370	.663	.849	.978	.576	.998	.221	.756
14.	.812	.443	.414	.411	.712	.978	.576	.942	-.040	.653
15.	.817	.699	.451	.839	.740	.978	.642	.914	.990	.759
16.	.863	.720	.750	.870	.856	.978	-.635	.932	.357	.672
17.	.816	.722	.446	.545	.880	.890	-.635	.952	.416	.618

Frequency of the responses in a tabular form

Summary of the results showing the various distribution of the responses

To have a quick glance through the results of this part of the questionnaire, a separate table with various distribution of percentages is given below: As many as thirteen statements out of seventeen have been found highly acceptable and all of them are listed earlier, so in this table simply the statement number for all the accepted items is given along with the percentages of agreements.

Statement No.	Very much agree %	Agree %	Uncertain %	Disagree %	Very much disagree%
1.	9.86	54.32	18.61	17.20	-
2.	17.28	49.38	17.23	14.82	1.23
3.	9.87	50.61	17.28	22.23	-
4.	20.98	55.55	13.58	9.88	-
5.	16.04	60.49	18.51	4.95	-
6.	14.81	64.19	14.81	6.18	-
7.	22.22	55.55	19.75	2.47	-
8.	20.98	59.27	16.04	3.70	-
9.	18.51	61.72	17.28	2.48	-
10.	23.47	43.20	20.98	12.34	-
11.	20.90	48.24	16.14	14.81	-
12.	22.22	44.44	17.28	16.05	-
13.	18.51	44.44	22.22	12.36	2.46

E. Design of Practical/Laboratory/Field work

Twenty seven questions were included in this fifth section of the questionnaire. All the questions were related to the design of practical/laboratory/field work. Teachers were asked to respond on a five point scale. Analysis of the results and interpretations for the same are given below:

1. There is a need to restructure our practical/laboratory/field work. There are many ways to do this. One way is to have both verification experiments (these remain the same year after year and batch after batch), investigation experiments in various areas. Verification experiments/practical/field work try to develop skills and abilities to verify the correctness of theory taught already, explore limitations etc. While investigation experiments certainly develop skills and abilities to solve a practical problem systematically without necessarily having to know the theory behind. Do you subscribe to this?

   With this statement 19.75% of the respondents have very much agreed, 60.49% agreed, 12.34% felt uncertain, 6.17% disagreed and only 1.23% very much disagreed. Since more than 80% of the respondents have agreed and very much agreed, the statement is highly applicable.

2. Very often laboratory/practical/field work is planned on the basis of a 'cycle' once or twice in a week. A group of students is asked to do an experiment/practical/field work and mostly one of them will do and others make use of his work. This happens more in verification experiment/practical field work.

   With this statement 17.28% of the respondents have very much agreed, 49.38% agreed, 14.81% felt uncertain and 18.51% disagreed. Since more than 66% of the respondents have agreed and very much agreed, this statement is also highly applicable.

3. Investigation experiment/practical/field work can be planned on a series of questions systematically designed to get answered by students (very often working individually). By the time, the student comes to the end, he would have performed a practical/an experiment/field work and will have

the thrill of having 'discovered' the theory behind. This type of 'discovery' learning is retained for long and is also capable of being applied else where etc.

With this statement 24.69% of the respondents have very much agreed, 60.49% agreed, 12.34% felt uncertain and only 2.46% disagreed. No one has very much disagreed Since the statement has been agreed and very much agreed by more than 85% of the respondents it is highly applicable.

4. The assessment of the knowledge regarding the apparatus could be undertaken by presenting the student with pieces of apparatus and requiring him to name them and to describe their use.

With this statement 17.28% of the respondents have very much agreed, 60.16% agreed, 21.32% felt uncertain and only 1.23% disagreed. Since more than 77% of the respondents have agreed and very much agreed, it is highly applicable.

5. The assessment of knowledge regarding the procedures of the practical/laboratory/field work could be undertaken by using objective items

With this statement 11.11% of the respondents have very much agreed, 65.43% agreed, 19.75% felt uncertain and only 3.70% disagreed. Since more than 76% of the respondents have agreed and very much agreed, this statement is also highly applicable.

6. The assessment of knowledge regarding the ways of using apparatus in the practical/laboratory/field work could be undertaken by asking the students to perform certain operations with the apparatus

With this statement only 7.40% of the respondents have very much agreed, 67.90% agreed, 19.75% felt uncertain and 4.93% disagreed. Since more than 75% of the respondents have agreed and very much agreed, this statement is highly applicable.

7. The assessment of the ability to use apparatus could be

undertaken by means of simple exercises involving the use of a particular piece of apparatus.

With this statement 12.34% of the respondents have very much agreed, 55.55% agreed, 27.16% felt uncertain and only 4.93% disagreed. Since more than 67% of the respondents have agreed and very much agreed, this statement is also applicable.

8. The assessment of the ability to implement procedures could be undertaken by providing simple instructions for the particular procedures and requiring the student to perform it.

With this statement 12.34% of the respondents have very much agreed, 74.07% agreed, 12.34% felt uncertain and only 1.23% disagreed. Since more than 86% of the respondents have agreed and very much agreed, the statement is highly applicable.

9. The assessment of the ability to select appropriate procedures for a particular practical problem could be undertaken by presenting the student with a practical problem and a range of alternative apparatus and procedures.

With this statement 14.81% of the respondents have very much agreed, 62.96% agreed, 16.04% felt uncertain and only 6.17% disagreed. No one has very much disagreed. Since more than 77% of the respondents have agreed and very much agreed with this statement, it is highly applicable.

10. The assessment of the ability to observe the material under investigation could be undertaken by requiring the student to translate his observations into oral or written terms.

With this statement 13.58% of the respondents have very much agreed, 66.66% agreed, 12.34% felt uncertain and only 7.40% disagreed. Since more than 80% of the respondents have agreed and very much agreed, the statement is highly applicable.

11. The assessment of the ability to observe changes or differences taking place in the material under investigation could be undertaken by presenting the student with a practical situation and requiring him to observe the changes which take place and to identify and isolate the changing factors in such a way that they can be studied more comprehensively.

With this statement 14.82% of the respondents have very much agreed, 69.13% agreed, 14.81% felt uncertain and only 1.23% disagreed. Since more than 83% of the respondents have agreed and very much agreed with this statement, it is also highly applicable.

12. The assessment of the ability to record appropriately observed material and the changes which take place in it would be undertaken by evaluating the use made by the student of the available methods of recording observations.

With this statement 8.64% of the respondents have very much agreed, 74.07% agreed, 16.04% felt uncertain and only 1.23% disagreed. Since more than 82% of the respondents have agreed and very much agreed, this statement is also highly applicable.

13. The assessment of the ability to devise new apparatus/techniques to meet the demands of a particular problem could be undertaken by providing the student with a situation in which the apparatus and techniques used and the problems posed are sufficiently within his level of competence.

With this statement 16.04% of the respondents have very much agreed, 46.99% agreed, 30.86% felt uncertain, 3.70% disagreed and only 2.46% very much disagreed. Since more than 63% of the respondents have agreed and very much agreed, this statement is also highly applicable.

14. The assessment of the ability to plan and carry out a practical investigation could be undertaken by presenting the student with a problem and requiring him to plan an appropriate practical procedure to solve it.

With this statement 18.51% of the respondents have very much agreed, 56.79% agreed, 20.98% felt uncertain and only

3.70% disagreed. Since more than 75% of the respondents have agreed and very much agreed with this statement, it is highly applicable.

15. It is felt, however, that to improve the content validity of our end practical/laboratory/field work examination we may follow a procedure somewhat like this. The various experiments in practical/laborory/field work are to be listed as content areas and abilities like knowledge/skill/abilities listed as ability dimension and a table of specifications prepared.

With this statement 17.28% of the respondents have very much agreed, 55.55% agreed, 24.69% felt uncertain, 3.70% disagreed and no one has very much disagreed. Since more than 77% of the respondents have agreed and very much agreed with this statement it is also highly applicable.

16. To improve the reliability, a combination of continuous assessment and end examination can be thought of and also abilities/skills that are to be assessed by both, decided earlier.

The end examinations will consists of either an objective type part or an oral part to take care of assessment of knowledge of instruments, limitations of instruments etc., and a few exercises to test skills and a few other to test abilities spread over the various content areas as set out in the table.

With this statement 23.45% of the respondents have very much agreed, 51.85% agreed, 19.75% felt uncertain and only 4.93% disagreed. Since more than 75% of the respondents have agreed and very much agreed, it is highly applicable.

17. Below is given an individual assessment format for laboratory/practical/field work.

S. No.	Practical No.	General Approach	Technique	Accuracy	Interpretation	Conclusion report	Total & Grade
		4	4	5	6	6	20
1.	I						
2.	II						

Do you agree with this format.

With this statement 12.34% of the respondents have very much agreed, 64.19% agreed and 23.45% felt uncertain. No one has disagreed and very much disagreed. Since more than 76% of the respondents have agreed and very much agreed with this statement it is highly acceptable.

18. Indicate the number of laboratory experiments/field work/ exercises/practical work you propose to give.

With this statement the respondents have suggested that at least 8 assignments should be given to a student during a semester and 14 assignments should be given during an academic year.

19. Indicate your class size.

With this statement the respondents have suggested at least a strength of 31 students for an average class size.

20. Indicate the way you would organize laboratory/field/practical work.

a. Once in a week
b. Once in a day
c. Once in a fortnight

For this statement 67.90% of the respondents have agreed for a, 11.11% agreed for b, and 20.98% have agreed for c.

21. Indicate the duration of laboratory/field/practical work as given in 19.

The respondents of this statement have suggested around $2\frac{1}{2}$ hour duration for the same.

22. Indicate as to how many of these would be i) individual or ii) group.

With this statement the respondents have suggested 3 hours for individual work and 5 hours for group work.

23. It is felt that traditional laboratory sheets giving aim, procedure, results, conclusion and reports based on this tend to encourage

copying from only one student who performs the work in the laboratory/field. In its place increasing use of laboratory sheets involving questions (answers) on an individual basis or programmed instruction material for handling instrument (in performing experiments) must be made to really make laboratories a learning place. What do you think of this proposal?

With this statement 18.51% of the respondents have very much agreed, 51.85% agreed, 23.45% felt uncertain and only 6.17% disagreed. Since more than 70% of the respondents have agreed and very much agreed with this statement, it is highly applicable.

24. It is also felt that laboratory/practical/field work in order to develop the kind of skills/abilities desired must be made up of verification as well as investigation types of exercises/experiments. This really means that certain experiments can be performed by students in an investigation type without even knowing the theory behind. These investigation experiments are so carefully planned that students will be led to 'discover', as it were, certain things which are not till then taught to them. In addition there is another value in it; this kind of investigation develops certain abilities/skills of experimentation innovation, discovery that there is overall satisfaction leading to better motivation on the part of students. How do you feel about this?

With this statement 17.28% of the respondents have very much agreed, 53.08% agreed, 23.45% felt uncertain and only 6.17% disagreed. Since more than 70% of the respondents have agreed and very much agreed with this statement, it is highly acceptable.

25. Do you feel that you can design "investigation" type of experiments yourself? Yes/No.

With this statement 70.37% the respondents have marked on 'yes' and 29.62% on 'no'. So it is highly applicable.

26. Do you consider that extra preparation and time are required on your part for this? Yes/No.

Since 98.76% of the respondents have marked on "yes" only

1.24% have marked on 'No', for this statement, it is highly applicable.

27. Do you agree with the format? Yes/No.

Since 96.29% of the respondents have marked on "yes" and only 3.71% have marked on "No", it is also highly applicable.

SUMMARY OF THE RESULTS OF SECTION 'E'

The consensus obtained for the statements of this section of the questionnaire regarding the design of practical/laboratory/field work reveals that all the twenty seven statements of this section have been unanimously accepted. The list of these accepted statements is given as below:

1. There is a need to restructure our practical/laboratory/field work. There are many ways to do this. One way is to have both verification experiments (these remain the same year after year and batch after batch), investigation experiments in various areas. Verification experiments/practical/field work try to develop skills and abilities to verify the correctness of theory taught already, explore limitations etc. While investigation experiments certainly develop skills and abilities to solve a practical problem systematically without necessarily having to know the theory behind. Do you subscribe to this?

2. Very often laboratory/practical/field work is planned on the basis of a 'cycle' once or twice in a week. A group of students is asked to do an experiment/practical/field work and mostly one of them will do and others make use of his work. This happens more in verification experiment/practical field work.

3. Investigation experiment/practical/field work can be planned on a series of questions systematically designed to get answered by students (very often working individually). By the time, the student comes to the end, he would have performed a practical/an experiment/a field work and will have the thrill of having 'discovered' the theory behind. This type of 'discovery' learning is retained for long and is also capable of being applied elsewhere.

4. The assessment of the knowledge regarding the apparatus could be undertaken by presenting the student with pieces of apparatus and requiring him to name them and describe their use.

5. The assessment of knowledge regarding the procedures of the practical/laboratory/field work could be undertaken by using objective items.

6. The assessment of knowledge regarding the ways of using apparatus in the practical/laboratory/field work could be undertaken by asking the students to perform certain operations with the apparatus.

7. The assessment of the ability to use apparatus could be undertaken by means of simple exercises involving the use of a particular piece of apparatus.

8. The assessment of the ability to implement procedures could be undertaken by providing simple instructions for the particular procedures and requiring the student to perform it.

9. The assessment of the ability to select appropriate procedures for a particular practical problem could be undertaken by presenting the student with a practical problem and a range of alternative apparatus and procedures.

10. The assessment of the ability to observe the material under investigation could be undertaken by requiring the student to translate his observations into oral or written terms.

11. The assessment of the ability to observe changes or differences taking place in the material under investigation could be undertaken by presenting the student with a practical situation and requiring him to observe the changes which take place and to identify and isolate the changing factors in such a way that they can be studied more comprehensively.

12. The assessment of the ability to record appropriately observed material and the changes which take place in it could be undertaken by evaluating the use made by the student of the available methods of recording observations.

13. The assessment of the ability to devise new apparatus/techni-

ques to meet the demands of a particular problem could be undertaken by providing the student in a situation in which the apparatus and techniques used and the problems posed are sufficiently within his experience for him to appreciate that the former are insufficient to solve the latter.

14. The assessment of the ability to plan and carry out a practical investigation could be undertaken by presenting the student with a problem and requiring him to plan an appropriate practical procedure to solve it.

15. It is felt however, that to improve the content validity of our end practical/laboratory/field work examination we may follow a procedure somewhat like this. The various experiments in practical/laboratory/field work are to be listed as content areas and abilities like knowledge/skill/abilities listed as ability dimension and a table of specifications prepared.

16. To improve the reliability, a combination of continuous assessment and end examination can be thought of and also abilities/skills that are to be answered by both decided earlier.

The end examination will consist of either an objective type part or an oral part to take care of assessment of knowledge of units, limitations of instruments etc., and a few exercises to test skills and a few other to test abilities spread over the various content areas as set out in the table.

17. Below is given an individual assessment format for laboratory/practical/field work.

S. No.	Practical No.	General Approach	Technique	Accuracy	Interpretation	Conclusion report	Total & Grade
		4	4	5	6	6	20
1.	I						
2.	II						

Do you agree with this format?

18. Indicate the number of laboratory experiments/field work/exercises/practical work you propose to give.

    I. during a semester
    II. during an academic year

19. Indicate your class size

20. Indicate the way you would organise laboratory/field/practical work.

    i. Once in a week
    ii. Once in a day
    iii. Once in a fortnight

21. Indicate the duration of laboratory/field/paractical work as given in 19.

22. Indicate as to how many of these would be

    i. Individual
    ii. Group

    If "Group", what is the optimum number of students in a group?

23. It is felt that traditional laboratory sheets giving aim procedure, results, conclusion and reports based on this tend to encourage copying from only one student who performs the work in the laboratory/field. In its place increasing use of laboratory sheets involving question (answers) on an individual basis or programmed instruction material for handling instruments '(in performing experiments) must be made to really make laboratories a learning place. How do you feel about this?

24. It is also felt that laboratory/practical/field work in order to develop the kind of skills/abilities desired must be made up of verification as well as investigation types of exercises/experiments. This really means that certain experiments can be performed by students in an investigation type without even

knowing the theory behind. These investigation experiments are so carefully planned that students will be led to 'discover', as it were, certain things which are not till then taught to them. In addition, there is another value in it; this kind of investigation develops certain abilities/skills of experimentation, innovation, discovery that there is overall satisfaction leading to better motivation on the part of students. How do you feel about this?

25. Do you feel that you can design "investigation" type of experiments yourself?

Yes/No

26. Do you consider that extra preparation and time are required on your part?

Yes/No

27. Do you agree with the format?

Yes/No

Frequency of the responses in a tabular form

Summary of the results showing the various distribution of the responses:

To have a quick glance through the results of this part of the questionnaire, a separate table with various distribution of percentage is given below. All the twenty-seven statements of this section have been found highly acceptable and all of them are listed earlier, so in this table simply the statement number for all the items is given along with the percentages of agreements.

Statement No.	Very much agree %	Agree %	Uncertain %	Disagree %	Very much disagree %
1	19.75	60.49	12.34	6.18	1.23
2.	17.28	49.38	14.81	18.52	-

Table No. 4

Correlation Values For the Items Of Section 'E'

As the respondents were classified into nine groups on the basis of their subjects, the correlation values (item-wise) for all the subjects were calculated and given below

tem No.	Zoology	Botany	Chemistry	Physics	Economics	Psychology	Commerce	Home Sc.	General Subjects	Total
1.	.516	.236	.718	.286	-.189	.723	.962	.790	.674	.639
2.	.505	.268	.054	-.064	.391	.336	-.841	.509	.737	.256
3.	.937	.170	.462	.316	.395	.000	-.666	.819	.857	.572
4.	.970	.342	.716	.000	.596	.806	-.768	.509	.888	.622
5.	.967	.230	.566	.858	.644	.571	.666	.635	.522	.591
6.	.716	.358	.819	.963	.644	.096	-.390	.624	.634	.669
7.	-.087	.468	.250	.000	.644	.096	.192	.933	.858	.467
8.	.970	.225	-.064	.710	.644	.571	-.962	.933	.806	.605
9.	.972	.576	.851	.000	.859	.096	-.962	.703	.797	.522
10.	.952	.510	.112	.900	.629	-.637	-.962	.718	.766	.568
1.	.785	.829	.390	.000	.629	-.571	-.962	.717	.503	.519
2.	.945	.562	.267	.858	.629	.739	.962	.745	.713	.563
3.	.844	.755	.529	.937	.633	.096	.962	.933	.850	.714
4.	-.031	.754	.451	.857	.624	.717	-.962	.624	.809	.535
5.	.455	.518	.661	.193	.014	.739	-.962	.345	.604	.417
6.	.142	.693	.699	.763	.014	.739	.962	.725	.807	.441
7.	.970	.711	.670	.858	-.084	.739	-.962	.717	.543	.532
3.	.096	.678	.694	.000	.465	.978	.904	.716	.609	.542
4.	-.260	.754	.761	.204	.670	.694	-.596	.450	.593	.533

3.	24.69	60.49	12.35	2.46	-
4.	17.28	60.16	21.32	1.23	-
5.	11.11	65.43	19.75	3.70	-
6.	7.40	67.90	19.75	4.94	-
7.	12.34	55.55	27.16	4.94	-
8.	12.34	74.07	12.35	1.23	-
9.	14.81	62.96	16.04	6.18	-
10.	13.58	66.66	12.35	7.40	-
11.	14.82	69.13	14.81	1.23	-
12.	8.64	74.08	16.04	1.23	-
13.	16.04	46.99	30.86	3.70	2.40
14.	18.51	56.79	20.98	3.71	-
15.	17.28	55.55	24.69	2.48	-
16.	23.45	51.85	19.75	4.95	-
17.	12.36	64.19	23.45	-	-
23.	18.51	51.85	23.45	6.19	-
24.	17.28	53.08	23.45	6.19	-

18. 8 assignments should be given to a student during a semester and 14 assignments during an academic year.

19. A strength of 31 students is suggested for an average class size.

20. 67.90% agreed for a) 11.11% agreed for b) and 20.98% have agreed for c).

21. The respondents of this statement have suggested around $2\frac{1}{2}$ hour duration.

22. For this statement the respondents have suggested 3 hours for individual works and 5 hrs. for group work.

25. For this statement 70.37% of the respondents have marked 'yes' and 29.62% on 'no'

26. For this statement 98.76% of the respondents have marked 'yes' and only 1.24% on 'no'.

27. For this statement 96.29% of the respondents have marked on 'yes' and only 3.71% on 'no'.

F. Marking versus grading for practical/laboratory/field work

In this last and sixth section of the questionnaire only eleven questions related to marking versus grading for practical/laboratory/field work were included. Teachers were asked to respond on a five point scale. The results were analysed and are as follows:

1. The numerical marking system provides a very inaccurate measurement of academic achievement. The marking system does not use the full range of marks 0 to 100 everywhere. A range of 20 to 55 is very common in History, Commerce and Psychology etc. The highest mark obtained by an outstanding student in Mathematics is nearly 100; an equally outstanding student of History gets somewhere about 58 which is not a first class mark since very often 60% and above is our 'arbitrary' first class. So it happens that in certain subjects students cannot get a first class however outstanding their performance may be.

   With this statement 34.56% of the respondents have very much agreed, 44.44% agreed, 13.58% felt uncertain, 6.17% disagreed and only 1.23% very much disagreed. Since 79% of the respondents have agreed and very much agreed with this statement, it should be considered highly applicable.

2. Often it happens that one examiner marks his papers from a high mark of 80 to a low mark of 30 while another marks his from 60 to 20. Such a difference is quite common in the numerical marking system and it is unfair to students. The unfairness would be eliminated if the marks were scaled to a common standard. The difference between one examiner's 80 and the other's 60 would then become immaterial. They would agree in this that these are the best papers and that is exactly what we need to know. The function of marks is to determine the rank order of the students. This therefore is the function of the examiner.

   With this statement 27.16% of the respondents have very much agreed, 58.02% agreed and only 14.81% felt uncertain. No one has disagreed. Since more than 85% of the respondents have agreed & very much agreed, it is highly applicable.

3. If we adopt a sound grading system in the place of marks most of the things mentioned above are taken care of.

With this statement 33.33% of the respondents have very much agreed, 49.38% agreed and only 14.81 felt uncertain. Since more than 82% of the respondents have agreed and very much agreed, it is highly applicable.

4. The present marking system is very simple, so simple that the marks of examiners are used for comparison when they are not comparable; they are not scaled, which they should be; raw scores in different subjects are added, which they should not be. This indeed is simplicity at the expense of all other standards.

With this statement 34.56% of the respondents have very much agreed, 46.91% agreed, 13.42% felt uncertain, 3.11% disagreed and only 2.43% very much disagreed. Since more than 81% of the respondents have agreed and very much agreed with this statement, it is also highly applicable.

5. It is readily appreciated that if all Indian Universities adopt the same grading system and interpret in the same way, then students can easily move from one university to another within a state or from one state to another. This is advisable and also desirable from the point of view of national integration.

With this statement 37.03% of the respondents have very much agreed, 49.38% agreed, 9.87% felt uncertain and only 3.70% disagreed. Since more than 86% of the respondents have agreed and very much agreed with this statement it is highly applicable.

6. Especially in the essay type examinations the error of measurement in terms of marks renders it difficult to make fine distinctions. A range of marks has better meaning then individual marks. If even after scaling an appreciable amount of error still remains, only grading can solve the problem.

With this statement 27.16% of the respondents have very much agreed 53.08% agreed, 14.81% felt uncertain and only 4.93% disagreed. Since more than 80% of the respondents have agreed and very much agreed, it is also highly applicable.

7. Under the system of grading there is the definite chance of getting an 0, the outstanding performance, whatever the discipline. As a result the choice of discipline and subject by students will be more influenced by their aptitude & ability.

With this statement 20.98% of the respondents have very much agreed, 49.38% agreed, 22.22% felt uncertain and 7.40% disagreed. Since more than 70% of the respondents have agreed and very much agreed with this statement, it is also highly applicable.

8. In practical/laboratory/field work, there are heads of assessment for every experiment/exercise. These are (as detailed out earlier) General approach, Technique, Accuracy, Interpretation and conclusion and Report. These lend themselves to grading rather than marking.

With this statement 17.28% of the respondents have very much agreed, 55.55% agreed, 18.51% felt uncertain and only 8.64% disagreed. Since more than 72% of the respondents have agreed and very much agreed with this statement, it is also highly applicable.

9. The Grading System recommended is the 7 point scale

O	Outstanding
A	Very good
B	Good
C	Average
D	Below Average
E	Poor
F	Very Poor

It is also recommended that 'Direct Grading' may be resorted to in assessing Practical/laboratory/field work.

With this statement 28.39% of the respondents have very much agreed, 49.38% agreed, 17.28% felt uncertain, 3.70% disagreed and only 1.23% very much disagreed. Since more than 77% of the respondents have agreed and very much agreed with this statement, it is highly applicable.

10. Assuming the format for assessment as given earlier.

S. No.	Description of Practical/ Lab. /Field work	Gen. Approach	Technique	Accuracy	Interpretation	Conclusion & Report	OVER ALL GRADE WEIGHTS GPA.
		4	4	5	6	6	
1.		A	A	O	A	B	

	Weight	Grade	Weight Grade	Remark	
General Approach	4	A	24	0	7
Technique	4	A	24	A	6
Accuracy	5	O	35	B	5
Interpretation	6	A	30	C	4
Conclusion & Report	6	B	30	D	3
			143	E	2
				F	1

Overall Grade $= \frac{143}{25} = 5.72$ A(5. 72)

With this statement only 14.81% of the respondents have have very much agreed, 39.50% agreed, 32.09% felt uncertain and 13.58% disagreed. Since only 53% of the respondents have agreed and very much agreed, it may not be considered as an applicable one.

11. Attitude to Practical/Laboratory/Field Work:

Attitude measuring scales are to be constructed and grading on a 5 point scale can be done. Here continuous internal assessment by the teacher making use of an attitudinal scale is much more meaningful and valid.

S. No.	Description	5	4	3	2	1
1.	Admires good students, teachers of the subject & literature					
2.	Is ready to undertake practical work					
3.	Is ready to undertake test					
4.	Examines every detail in the practical/laboratory problems.					
5.	Seeks fresh clues beyond the ones known.					
6.	Reports observations without working up (cooking)					
7.	Accepts mistakes without reservation.					
8.	Is ready to experiment again					
9.	Sticks to the practical/laboratory/field problem and never leaves it unsolved.					
10.	Takes pleasure in doing practical/laboratory/field work					

With this statement 9.87% of the respondents have very much agreed, 59.25% agreed, 25.92% felt uncertain and only 4.93% disagreed. Since more than 69% of the respondents have agreed and very much agreed, it may be considered as highly applicable.

SUMMARY OF THE RESULTS OF SECTION 'F'

The consensus obtained for the statements of this section of the questionnaire regarding marking versus grading for practical/laboratory/field work reveals that as many as ten out of eleven statements have been unanimously accepted. The list of all these statements is given below:

1. The numerical marking system provides a very inaccurate measure-ment of academic achievement. The marking system does not use the full range of marks 0 to 100 every where. A range of 20to 55 is very common in History, Commerce and Psychology etc. The highest mark obtained by an outstanding student in Mathematics is nearly 100; an equally outstanding student of History gets somewhere about 58 which is not a first class mark since very often 60% and above is our arbitrary first class. So it happens that in certain subjects students cannot get a first class however outstanding their performance may be.

2. Very often it happens that one examiner marks his papers from a high mark of 80 to a low mark of 30 while another marks his from 60 to 20. Such a difference is quite common in the numerical marking system and it is unfair to students. The unfairness would be eliminated if the marks were scaled to a common standard. The difference between one examiner's 80 and the other's 60 would then become immaterial . They would agree in this that these are the best papers and that is exactly what we need to know. The function of marks is to determine the rank order of the students. This therefore is the function of the examiner, more than anything else.

3. If we adopt a sound grading system in the place of marks most of the things mentioned above will be taken care of.

4. The present marking system is very simple, so simple that the marks of examiners are used for comparison when they are not comparable: they are not scaled, which they should be; raw scores in different subjects are added, which they should not be. This, indeed, is simplicity at the expense of all other standards.

5. It will be readily appreciated that if all Indian Universities adopt the same grading system and interpret it in the same way, then students can easily move from one university to another within a state or from one state to another. This is advisable and also desirable from the point of view of national integration.

6. Especially in the essay type examinations, the error of measurement in terms of marks renders it difficult to make fine distinctions. A range of marks is more meaningful than individual marks. If even after scaling an appreciable amount of error still remains, only grading can solve the problem.

7. Under the system of grading there is a positive chance of getting an 0, the outstanding performance, whatever the discipline. The choice of discipline and subject by students will be more influenced by their aptitude and ability as a result.

8. In practical/laboratory/field work, there are heads of assessment for every experiment/exercise. These are (as detailed out earlier) General approach, Technique Accuracy, Interpretation Conclusion and Report. These lend themselves to grading rather than marking.

9. The Grading system recommended is the 7 point scale

O	Outstanding
A	Very good
B	Good
C	Average
D	Below average
E	Poor
F	Very poor

It is also recommended that 'Direct Grading' may be resorted to in assessing practical/laboratory/field work.

10. Attitute to Practical/Laboratory/Field work.

Attitude measuring scales should be constructed and grading on a 5 point scale should be done. Here continuous internal assessment by the teacher making use of an attitudinal scale is much more meaningful and valid.

S. No.	Description	5	4	3	2	1
1.	Admires good students, teachers of the subject & literature					
2.	Is ready to undertake practical work					
3.	Is ready to undertake test					
4.	Examines every detail in the practical/laboratory problems.					
5.	Seeks fresh clues beyond the ones known.					
6.	Reports observations wi without working up (cooking)					
7.	Accepts mistakes without reservation.					
8.	Is ready to experiment again					
9.	Sticks to the practical/laboratory/field problem and never leaves it unsolved.					
10.	Takes pleasure in doing practical/laboratory/field work.					

Do you think that this is possible at least 2 or 3 times in a semester/or in a year for all students?

Frequency of the responses in a tabular form

Summary of the results showing the various distribution of the responses

To have a quick glance through the results of this part of the questionnaire, a separate table with various distribution of percentage is given below. Out of eleven statements as many as ten of this section have been unanimously accepted and all of them are listed earlier, so in this table simply statement number for all the items is given along with the percentages of agreements.

Statement No.	Very much agree %	Agree %	Uncertain %	Disagree %	Very much disagree %
1	34.56	44.44	13.58	6.18	1.23
2.	27.16	58.02	14.81	-	-
3.	33.33	49.77	16.89	-	-
4.	34.56	46.91	13.42	3.11	2.43
5.	37.04	49.38	9.87	3.70	-
6.	27.16	53.08	14.81	4.94	-
7.	20.98	49.38	22.22	7.41	-
8	17.28	55.55	18.52	8.64	-
9.	28.39	49.38	17.29	3.70	1.23
10.	9.87	59.25	25.94	4.93	-

Table No. 5

Correlation Values For the Items of Section -'F'

As the respondents were classified into nine groups on the basis of their subjects, the correlation values (item-wise) for all the subjects were calculated and given below

Item No.	Zoology	Botany	Chemistry	Physics	Economics	Psychology	Commerce	Home Science	General subjects	Total
1	.737	.745	.986	.488	.980	.906	.042	.744	.774	.338
2	.876	.734	.989	.139	.656	.653	.042	.658	.924	.345
3	.832	.965	.971	.000	.572	.545	.044	.840	.947	.378
4	.741	.953	.981	-.180	.728	.993	.042	.781	.782	.351
5	.876	.924	.960	-.276	.980	.545	.036	.744	.912	.369
6	.719	.930	.983	.000	.980	.545	.035	.840	.907	.376
7	.752	.690	.923	.841	.814	.653	.025	.959	.852	.335
8	.894	.917	.971	.279	.922	.526	.042	.992	.925	.256
9	.845	.706	.869	.000	.950	.526	.044	.781	.905	.333
10	.611	.934	.807	.408	.980	.985	.044	.737	.705	.306
11	.568	.679	.762	.488	.346	.985	.041	.967	.629	.283

SECTION V

CONTINUOUS INTERNAL ASSESSMENT AND END PRACTICAL EXAMINATION

CONTINUOUS INTERNAL ASSESSMENT & END PRACTICAL EXAMINATION

'Internal assessment' is often used as if it was synonymous with continuous assessment. It may often be so but it is not necessary that it should be. Similarly 'course work' is sometimes used as if it was the same as 'continuous assessment'. This is by no means always the case; in certain circumstances course work can perfectly be assessed on a single occasion by an external agency. Many teachers believe that a realistic measure of attainment is possible when such an assessment is based on the student's work performed during the normal period of his course. Certain questions set by the external examiners take into account only the kind of interpretation this examiner gives to this syllabus. Students respond to these questions on the occassion of end examination. Until that specific occassion, the only item common to both examiner and student is the examination syllabus. If the objectives of such a syllabus were stated in the most useful form for teaching and assessing i.e., in terms which specified the kind of behaviour it was expected the student would acquire during the course and the content of study in which this behaviour would operate, then this assessment and assessment of course work could only be complementary.

Need for continuous Internal Assessment

In order to evaluate each individual student as objectively as possible, it is necessary to break down the student's total performance or total behaviour pattern in relation to a particular course of study. This task is performed through a precise statement of objectives which sets down the abilities, skills and behaviour expected of students at the end of courses as a result. of having followed them. We know, however, that no single aspect of a student's behaviour can be understood without reference to the total behaviour pattern i. e. without reference to the whole person. A way of redressing the balance is through continuous assessment carried out by the student's own teacher who is in a unique position to see the student as a whole person as well as to help with the assessment of his progress analytically. For the sake of validity, it may be argued that the process of assessing a student's progress should be continuous. In this sense, written tests, oral questioning and discussions, projects, reports, class-work, homework etc. are all considered to be assessment measures. Therefore records need to be kept. Continuous assessment in one sense simply means gaining more and better information about the student and using this as the course develops. At the outset it is essential to establish what is meant by continuous internal assessment.

i. Continuous internal assessment represents continuous awareness by the teacher of the development and knowledge of his students. It is a process which extends over a period of time; the gradual build-up of a cumulative judgement about performance.

ii) A teacher making use of continuous assessment is looking for signs which show the growth of thinking process and the development of those varying abilities towards which the teaching is aimed.

iii) An end of course examination will test achievement at one point of time within the limits of test. Under continuous assessment there is knowledge not only of this achievement but also of progression towards it not merely of where he has got to but also of how he got there.

There is no doubt about it that both the 'External end examination' and 'continuous internal assessment' are equally important. Therefore, it is essential that teachers should desire the adoption of continuous internal assessment as a method of measuring attainment within the context of an external nationally recognized examination. Keeping in view the merits and demerits of both the 'external end examination' and 'continuous internal assessment' it is essential to use the same for the practical/laboratory/field work examinations. Few of the selected merits and demerits for both the systems are given below:

Merits of End External Examination:

This is the most important and universally accepted means of assessment. The following are the merits of this system of evaluation:

i) It provides an independent assessment whose results are most likely to be accepted by the users of examination results.

ii) It provides for uniformity of practice and standards with all students being assessed upon common qualities by common criteria.

iii) It concentrates resources and expertise for setting and marking.

iv) It obviates the possibility of any conflict arising between the teacher as a teacher and the teacher as an assessor.

v) It provides an assessment procedure unaffected by personal relationships between teacher and students.

Demerits of End External Examination

i) The means of external examinations are limited to those which can be administered by an external agency.

ii) The external assessment may exercise a restricting influence upon the practical/laboratory/field work carried out in institutions.

iii) The external assessment is limited to the outcomes of practical work and does not include a consideration of how the work is carried out.

iv) The number of occasions upon which the external assessment can take place is limited for administrative reasons.

Merits of Continuous Internal Assessment

i) The danger of chance failure or success in the internal assessment is decreased by making assessment possible on a number of occasions.

ii) During internal assessment a wide variety of means of assessment may be used covering a wide variety of qualities.

iii) Internal assessment requires teachers to think about assessment in terms of educational and assessment objectives.

iv) Internal assessment enables students to be assessed on how they undertake practical work as well as on its outcomes.

v) Internal assessment in the practical work is likely to be more objective than external assessment.

Demerits of Continuous Internal Assessment

i) Internal assessment in practical work can some times endanger the relationship between teacher & student

ii) Internal assessment in the practical work makes it difficult to relate and compare standards between institutions/colleges.

iii) Internal assessment in the practical work can give rise to suspicions in the mind of users about the validity and reliability of the results of the assessment.

It is, therefore, obvious that both end external examination and 'continuous internal assessment' are equally important aspects of the same coin. Internal assessment should not be taken as something to replace the end examination. Both have a part to play in a planned evaluation system. Very often the end examination is to be taken as a part of the internal assessment. Some basic principles have to be taken into consideration in the implementation of the internal assessment system.

Basic Principles

The introduction of internal assessment in contrast to the present point-in-time examination is an important step towards the integration of the trinity of functions namely teaching, learning and testing. At present the performance of students is judged entirely at the end of the year, semester or course examination, usually of three hour duration in which they are expected to produce answers to stereotyped questions involving a great deal of memory work. By simple repetition of stereotyped questions, various abilities involving higher cognitive operation like analysis, synthesis and evaluation are replaced by simple memory. The introduction of internal assessment will enable certain intellectual abilities and skills that are not tested by end external examinations, will be developed and tested and assessed. Certain fundamental principles of internal assessment to get a comprehensive idea of the same are explained here as follows:

i) Internal assessment is continuous, periodic and internal. This means that assessment is done in relation to certain abilities and skills in certain subject areas periodically and continuously. This has to be planned at the time of curriculum development, syllabus interpretation and clarifying objectives of learning. This is internal in the sense that the teacher/ instructor of the subject in the institute is to assess and no external agency comes in.

ii) Internal assessment does not mean only a few mid-term examinations in the place of final examination.

iii) Internal assessment demands that the outcomes of learning a particular subject must be spelt out first and then the choice of suitable, meaningful, valid and reliable evaluation tools to match these abilities and skills is made.

iv) The main purpose of introducing internal assessment is to integrate teaching and evaluation and to test those skills and abilities which cannot be tested through a written examination at the end of a course. In internal assessment very low weightage must be given to testing simple recall of knowledge and information.

v) The question of giving weightage to internal assessment and end examinations (external) is important. In a unitary university/autonomous college this question does not arise since a design of internal assessment can be done including the end examination as a part of it. In an affiliating type of university, dealing with a good number of colleges, the question of fixing weightage for internal assessment and end university examination exists and this can be tackled in one of the following ways:

  a. Internal assessment and external end university examination marks or grades can be shown separately.

  b. Various percentages have been fixed and are being adopted. While it will be difficult to say what percentage is ideal, it is worthwhile to quote the study of F. W. Starr (Bristol University)"Combining internal and external for education courses". He tried all kinds of percentages and finally recommends that a 50-50 proportion for internal and external assessment correlates better than the all other combinations.

vi) Internal assessment marks or grades must be open. The marks or grades obtained by students must be made known to them immediately after evaluation is completed.

vii) Internal assessment results must be studied statistically and an effort must be made to improve the system based on these results.

It is, therefore, needless to state that objectives of laboratory work must be made clear to students. They must be encouraged to do both verification type and investigation type of experiments to promote learning in the laboratory. Objectives of laboratory work range from knowledge (of instruments, ways of using instruments, limitations of instruments) to abilities (to observe, make measurement, record, draw conclusions, write a report, devise new apparatus, devise new procedures to solve a problem) and skills (in handling instruments with ease, in making observations, handling data and computing). The related laboratory work must be spelt out at the beginning of the course and every laboratory experiment performed by individual students must be assessed on the basis of general approach, technique, accuracy, interpretations, conclusions by adopting different weightages.

SUMMARY OF THE RESULTS OF SECTION V

The consensus obtained for the statements regarding the continuous internal assessment and end practical examination given in the questionnaire reveals that as many as thirteen statements out of seventeen were found highly applicable and the same are listed below:

1. External assessment provides an independent assessment whose results are most likely to be accepted by the users of examination results.

2. External assessment provides for uniformity of practice and standards with all students being assessed upon common qualities by common criteria.

3. External assessment obviates the possibility of any conflict arising between the teacher as a teacher and the teacher as an assessor.

4. External assessment provides an assessment procedure unaffected by personal relationships between teacher and students.

5. The number of occasions upon which the external assessment can take place is limited for administrative reasons.

6. In the Practical/Laboratory work, the danger of chance

failure or success in the internal assessment are decreased by making assessment possible on a number of occasions.

7. During the internal Assessment of practical/Laboratory work, a wide variety of means of assessment may be used covering a wide variety of qualities.

8. Internal assessment of the practical/laboratory work requires teachers to think about assessment in terms of educational and assessment objectives.

9. Internal assessment of the practical/laboratory work enables students to be assessed on how they undertake practical work as well as on its outcomes.

10. Internal assessment in the practical/laboratory work is likely to be more objective than external assessment.

11. Internal assessment in the practical/laboratory work can some times endanger the relationship between teacher and student.

12. Internal assessment in the practical/laboratory/field work makes it difficult to relate and compare standards between institutions/colleges.

13. Internal assessment in the practical/laboratory/field work can give rise to suspicions in the minds of users about the validity and reliability of the results of the assessment.

SECTION VI

MARKING Vs GRADING FOR PRACTICAL/LABORATORY/FIELD WORK

MARKING Vs GRADING FOR PRACTICAL/LABORATORY/ FIELD WORK

The numerical marking system in both theory and practical examinations provides a very inaccurate measurement of academic achievement. Students are marked on each examination paper on a scale from 0 to 100, though the full scale is seldom used. Every students' obtained mark is supposed to be a measure of the quality of his answers. At the same time, a student's mark on different papers are combined to give his aggregate mark for all of his subjects. Very often an evaluation is applied to the aggregate mark. If this aggregate is as high as 60% of the possible total, the student is said to be in the first division; otherwise his mark is in the second or third division or he has failed. The suggestion that we should replace this system with the grade system is based on a number of important considerations and valid criteria.

1. Accuracy: The numerical marking system provides a very inaccurate measurement of academic achievement. A few of the reasons why this is so can be given now.

i) The standard of examiners differs widely. Research proves that it is a fact, that judgements of examiners are significantly different when they are marking equivalent sets of answer books and even when different equally competent examiners have marked the same individual answer book. Surely, we want a student's mark to depend on the quality of his answers rather than on which examiner happened to mark his answers. If we want to persist in the numerical marking system and still want to realise this goal we would have to scale the mark of examiners to a common standard.

ii) Examiners very frequently decide who should pass and who should fail. If the passing mark is 35, they give an unusual number of 35 and very few marks of 34 or 33. Similar bunching may be found at the minimum marks for first and second divisions. But this is indulging in evaluation when they are only required to measure the examinee's performance. There is a distortion of results here, which can be avoided in the grading system.

iii) It is a matter of common experience that in some subjects like Mathematics the highest mark awarded may be 100 and the lowest 0 or close to 0. In many other subjects this never happens. The highest mark for instance may be 70 and the lowest mark 20. Thus for what is considered to be a 100 mark paper, the actual range of marks is only 50. When the marks of different papers are added, the subject in which a wide range of marks is used has a disproportionate effect on the total result. This certainly leads to a great deal of irrationality in the choice of subjects or of papers and in regard to the time given by a student to the study of particular subjects or papers. Such irrationality can be obviated by scaling the marks to a common standard, but the better alternative is to use grades in the place of marks.

2. Familiarity: As regards this,much can be said in favour of the percent numerical marking system. Ruch criticises the numerical marking system on the ground that it implies a precision that is seldom attainable. Hill (1972) observes "The present percent marking system is familiar to teachers, students, employers and the public; and all of them think they know what it means; the trouble is that too much of what they know is not true. The marking scale is highly misleading. Marks are not, though they appear to be, awarded on an absolute scale; for there is no absolute scale."

The numerical marking system is looked upon as a fixed and dependable standard, which it is not. Suppose three students obtain 60, 59 and55 marks respectively in a particular paper. Everyone of us is bound to interpret that the one who obtained 60 marks is better than the one who got 59 but certainly much better than the third who got 55. The University goes so far as to place one of these in the first division and the other two in the second. There are two major assumptions here -i) The marking scale is absolute; ii) The marks are free of errors. Neither of these is justified.

A student's mark has a real meaning only as a number to compare with numbers assigned to other students. These numbers are only estimates and they are subject to considerable error. Taylor, after making calculations for many university examinations, has said that for examinations in India, this probable error in marking is normally about five and often as high as seven. The U.G.C. report on 'Examination Reform A Plan of Action, 1973' has shown that when an examiner assigns a mark to a student, there is a 50% chance that his error is greater than 5%. This means that where a candidate is awarded a raw mark of 41, the true mark may be either above 46 or below 36 in 50% of the cases. Under these circumstances, the 101 point scale where candidates are distinguished in steps of one mark, loses all its significance. If then we consider our three students whose marks are 60, 59 and 55, one who got 59 should be between 55 and 65 and that range includes the true marks of all the three students. Since the advantage of familiarity is offset by serious misconceptions in the case of numerical marks, we must opt in favour of grades.

3. Simplicity: The present marking system is very simple, so simple that the marks of examiners are used for comparison when they are not comparable: they are not scaled, which they should be; raw scores in different subjects are added, which they should not be. This, indeed, is simplicity at the expense of other standards. In University examinations, scaling of marks should have been adopted. Some pioneers have done this (Gaunati). Instead of depending too much on human labour (to again make it simple) some of the work of recording, checking, tabulating and scaling could be done by machine and in India such equipment is available with universities. If we adopt a sound grading system in the place of marks, most of the things mentioned above are taken care of. But then the question comes up how to award grades, interpret grades and add grades. To answer this, we have to look at two distinct things namely, i) a technical proposal for awarding grades to answer papers and ii) Grading system its problems and solutions.

From Marks to Grades

Very often it happens that one examiner marks form a high mark of 80 to a low mark of 30 while another marks from 60 to 20 - such a difference is quite common, and it is unfair to students. The unfairness would be eliminated if the marks were scaled to a common standard. The difference between one examiner's 80 and the other's 60 would then become immaterial. The function of marks is to determine the rank order of students.

It is not proposed that we should abandon marks as such. Marks are useful, but they are misused. Numerical marks can be the beginning of the marking procedure, but they should not be the end. The pragmatic but scientific way to look at it is that examiners should mark just as they have been doing but then the final report of the results should not be in the form of numerical marks. There are several procedures, one such would be somewhat like this:

Answer sheets of the practical examinations that are to be marked should be thoroughly randomised. This will ensure that all examiners will be marking sets of answer books that are equivalent in quality. Each examiner has both good and bad ones and each set (or bundle) is not better or worse than any other. In such a case we can be reasonably sure that differences in the marks of examiners may be attributed to their different standards of marking, not to differences in the abilities of students. Also the identity of the student and of his college should be removed from each answer book. After the examiners have assigned the marks the university does the scaling and then grading. The Dandekar method is recommended for the same as it is felt that this method of scaling can lead directly to a system of grading. Dandekar has given the normal distribution of the range of marks amongst the population, but the distribution of marks as given by the examiners is usually not normal and often far from being normal. He, therefore, feels that the frequency distribution of marks in the earlier years is better than applying the normal distribution. The simplest and most direct description of a pattern of distribution is to indicate the number or the proportion of candidates who have secured marks between certain ranges. The second column (percentage of candidates) represents a decision that the entire range of marks shall be divided into 7 groups and that each group shall contain the indicated percentage of students. The third column (range of marks) is determined empirically. It is based on the actual marks awarded in the particular subject. For awarding the grades, consider the following table:

S. No.	Percentage of Candidates	Range of marks	Letter grade	Description	Points
1	3%	79 and above	O	Outstanding	6
2.	7%	73 - 78	A	Very good	5
3.	22%	65 - 72	B	Good	4
4.	36%	53 - 64	C	Average	3
5.	22%	40 - 52	D	Below average	2
6.	7%	32 - 39	E	Poor	1
7.	3%	$<$ 30	F	Very poor	0

Letter grades would thus be the symbols to be used in announcing examination results. These grades would be assigned for each paper in the examination. The overall grades are needed if we wish to combine the grades for different papers. Assuming that there are eight papers for the course each carrying 100 marks and that the grades obtained by a student are O, A, A, B, A, B, A, B in different theory and practical papers, the grade point average of the student, according to our 7 point scale, would be

$$\frac{6+5+5+4+5+4+5+4}{8} = \frac{38}{8} = 4.75 \rightarrow A$$

If each of these papers is weighted in the order of, say 4, 2, 1, 4, 2, 2, 4, 4, the grade point would be calculated as under:

$$\begin{array}{lcr}
6 \times 4 & = & 24 \\
5 \times 2 & = & 10 \\
5 \times 1 & = & 5 \\
4 \times 4 & = & 16 \\
5 \times 2 & = & 10 \\
4 \times 2 & = & 8 \\
5 \times 4 & = & 20 \\
4 \times 4 & = & \underline{16} \\
 & & \underline{109}
\end{array}$$

$$\text{Grade point average:} = \frac{\text{Total grade points}}{\text{Sum of weights}}$$

$$= \frac{109}{4+2+1+4+2+2+4+4} \quad \frac{109}{23}$$

$$= 4.74 \rightarrow A.$$

Assigning Grades: Grades can be assigned in one or the other of two ways:

1. By converting marks into grades: In this procedure various heads of assessment are decided and marks are allotted. A student's work is assessed on individual heads of assessment, total marks found out, and then converted into grades.

2. On absolute standard: Standardised and graded projects, assignments and these are collected and studied. If a new project assignment or thesis is to be assessed a comparison is made of this with the graded ones and grade decided on this basis.

Grading Vs. Marking:

It may be relevant here to further elaborate on the advantages that grading gives as compared to the marking system. At present, different universities adopt different cut-off points for award of divisions/classes and the minimum pass percentages in different subjects are on an absolute rather than a relative scale, whereas the same may be blown off with the use of grading system. Evaluation, which is mainly judgement based on measurement, is different in universities in the same subject at the same level. Such an evaluation is not uniform especially when the numerical marking scale is adopted. If all the Universities, on the other hand, agree to adopt say the 7 point grading scale, and also establish relationship between various grades and their meanings in qualitative terms, then there is better uniformity in evaluation. A very good performance in a particular subject will receieve an A in all universities, and one who has got an A in a subject will everywhere be considered to have done very well in that subject. In this grading system there are seven categories of performance viz: Outstanding, verygood, good, average, below average, poor and very poor, No classes or divisions are given, but only letters O, A, B, C, D, E and F. If teachers/examiners are able to adopt "direct grading", then there is better uniformity amongst universities.

It would be easily appreciated that if all Indian Universities adopt the same grading system (seven-point scale) and interpret it in the same way, then students can easily move from one university to another within a state or from one state to another. This is advisable and also desirable from the point of view of national integration. It is also necessary that teachers are inducted into this system by training at the workshops organised by the university at different centres. The implication of the adoption of this system in terms of teachers, students, parents and administrators must be clearly understood. This kind of preparation for implementing a sound grading system is educationally very important, but only a few universities have so far realised and acted upon it. It is hoped that the experience of this system would stimulate others to take it up more seriously in the interest of students. It is, therefore, obvious that the success of this system will largely depend on the teachers, their understanding, training, potential, unbiased attitude and above all the 'professionalism' they bring to their work of teaching - learning - testing. An organised way of designing, publicising and training will of course be necessary for successful implementation.

SUMMARY OF THE RESULTS

A separate section given in the questionnaire with eleven questions dealing with the aspects of marking versus grading system for practical/laboratory/field work examinations was analysed to see the consensus of the teachers on the same. The results obtained reveal that as many as 10 statements out of 11 were found highly applicable and the list of these statements is given below:

1. The numerical marking system provides a very inaccurate measurement of academic achievement. The marking system does not use the full range of marks 0 to 100 everywhere. A range of 20 to 55 is very common in History, Commerce, Psychology etc. The highest mark obtained by an outstanding student in Mathematics is nearly 100; an equally outstanding student of History gets somewhere about 58 which is not a first class mark since very often 60% and above is our arbitrary first class. So it happens that in certain subjects students cannot get a first class however outstanding their performance may be.

2. It often happens that one examiner marks his papers from

a high mark of 80 to a low mark of 30 while another marks his from 60 to 20. Such a difference is quite common in the numerical marking system and it is unfair to students. The unfairness would be eliminated if the marks were scaled to a common standard. The difference between one examiner's 80 and the other's 60 would then become immaterial. They would agree in this that these are the best papers and that is exactly what we need to know. The function of marks is to determine the rank order of the students. This therefore is the function of the examiner above everything else.

3. If we adopt a sound grading system in the place of marks most of the things mentioned above will be taken care of.

4. The present marking system is very simple, so simple that the marks of examiners are used for comparison when they are not comparable: they are not scaled, which they should be; raw scores in different subjects are added, which they should not be. This, indeed, is simplicity at the expense of all other standards.

5. It would be readily appreciated that if all Indian Universities adopt the same grading system and interpret it in the same way, then students can easily move from one university to another within a state or from one state to another. This is advisable and also desirable from the point of view of national integration.

6. Especially in the essay type examinations, the error of measurement in terms of marks renders it difficult to make fine distinctions. A rang of marks is more meaningful than individual marks If even after scaling an appreciable amount of error still remains grading alone can solve the problem.

7. Under the system of grading there is the definite chance of getting an 0, the outstanding performance, whatever the descipline. The choice of discipline and subject by students will be better influenced by their aptitude and ability under this method.

8. In Practical/Laboratory/Field work, there are Heads of

assessment for every experiment/exercise. These are (as detailed out earlier) General approach, Technique, Accuracy, Interpretation and Conclusion and Report. These lend themselves to Grading rather than marking.

9. The Grading System recommended is the 7-point scale

O	Outstanding
A	Very good
B	Good
C	Average
D	Below average
E	Poor
F	Very poor

It is also recommended that 'Direct Grading' can be resorted to in assessing Practical/laboratory/field work.

10. Attitude to Practical/Laboratory/Field work.

Attitude measuring scales should be constructed and grading on a 5 point scale should be done. Here continuous internal assessment by the teacher making use of an attitudinal scale is much more meaningful and valid.

S. No.	Description	5	4	3	2	1
1.	Admires good students, teachers of the subject & literature.					
2.	Is ready to undertake practical work					
3.	Is ready to undertake test					
4.	Examines every detail in the practical/laboratory problems.					
5.	Seeks fresh clues beyond the ones known					

6. Reports observations without working up (cooking)
7. Accepts mistakes without reservation.
8. Is ready to experiment again
9. Stick to the practical/laboratory/field problem and never leaves it unsolved.
10. Takes pleasure in doing practical/laboratory/field work.

Do you think that this is possible at least 2 or 3 times in a semester/or in a year for all students?

SECTION VII

CONCLUSIONS

CONCLUSIONS

The evaluation of a student's performance in Practical/Laboratory/Field work is thus seen to be comprehensive enough to include certain kinds of measurements of knowledge/abilities/skills aspects during and after the teaching/learning process involved in Practical/Laboratory/Field work relevant to the subject discipline. In any comprehensive evaluation scheme or system, one is concerned with:

a) a set of learning outcomes to be assessed during the course and at the end.

b) a set of measuring tools and devices to validly and reliably measure these outcomes.

c) a set of value judgment to these measurements consistant with measurement inaccuracies and errors.

d) a set of procedures evolved as a result of evaluation to improve the process of teaching/learning in Practical/Laboratory/Field work.

The following conclusions emerge from this research:

Practical/Laboratory/Field work has been seen to constitute an important element in the Teaching/Learning process and the development of Practical/Laboratory/Field work skills has been established as an important desirable outcome of learning in many courses in many subject areas. While Practical/Laboratory/Field work is inherent in many science and professional courses (engineering, technology and medicine etc.) field work seems to be an important component of social and human sciences.

There is an urgent need for improving the practical/laboratory/field work examination because it enhances the theoretical knowledge and practical skill as both are complementary to each other. It gives the training to handle sophisticated apparatus, to improvise apparatuses, to demonstrate and reinforce the principles set out in theoretical lectures. The practical/laboratory/field work being an important outcome of teaching really emphasizes the activities for doing rather than the knowing. Practical work given in the form of projects can also be designed to serve the same purpose. In addition (individual) projects help to bring out the problem solving skills of individuals; group projects in addition help students to work as a team (a very nearlife situation). It also familiarizes the students with the methods of collecting data, analysis and interpretation of data and the way of preparing scientific and technical report. In addition to all these things some additional laboratory work can be planned to develop skills of handling instruments, manipulating, recording and to infer and write a report and so on.

If we look into the present modes of the assessment of practical/laboratory/field work, it is inefficient and traditional and therefore lacks innovation. It has generally been found that we use the same experiments for the practical/laboratory/field work year after year, there is a tendency among students to borrow the practical note books from students of earlier years. Moreover, the assessment procedure for practical/laboratory/ field work is very much biassed. The students having good rapport with their teachers secure better marks/grades. Since a large number of students are examined in a limited time, it becomes a problem for the examiners to make a real assessment of their abilities. There is a 'chance factor' in the practical examinations where a student has to pick-out from a number of experiments/practicals for the examination. It may well happen that a student may land up with the one that he had not performed. The practical examinations are generally conducted in different batches and a fixed number of laboratory test questions are repeated for every batch with a minor variation of data. The content validity is very low for these examinations as the scores do not cover a wide range e.g. the range of marks is usually between 60% to 90% and thus it becomes difficult to discriminate between good and poor students.

It is assumed that the external assessment, which is highly popular in our examinations provides an independent assessment whose results are most likely to be accepted by the users of examination results. Moreover, it provides an assessment procedure unaffected by personal relationship, also obviates the possibility of any conflict arising between the teacher as a teacher and the teacher as an assessor. In addition to this it provides for uniformity of practice and standards with all students being assessed upon common qualities by common criteria. Despite these things the number of occasions upon which the external assessment can take place is limited for administrative reasons. Internal assessment is the only alternative to bridge this gap. As the danger of chance failure or success in the internal assessment are decreased by making assessment possible on a number of occasions and also it requires teachers to think about assessment in terms of educational and assessment objectives. Sometimes the internal assessment in the practical/laboratory work endangers the relationship between teacher and student, also makes it difficult to relate and compare standards between institutions/colleges. Despite all these things it is likely to be more objective than external assessment.

There is a need to restructure our practical/laboratory/field work and there are many ways to do this. One way is to have both verification experiments (these remain the same year after year and batches after batches), investigation experiments in various areas. Verification experiments try to develop skills and abilities to verify the correctness of theory taught already, explore limitations etc. While investigation experiments certainly develop skills and abilities to solve a practical problem systematically without necessarily having to know the theory behind. The assessment of the knowledge of the students regarding the apparatuses, procedures, could be undertaken by presenting the student with pieces of apparatus and by using objective items. The assessment of the ability to implement procedures to select appropriate procedures to observe the material under investigations could be undertaken by providing simple instructions, presenting the student with a practical problem and by requiring the student translate his observations into oral or written terms. It is felt however that to improve the content validity of our end practical/laboratory/field work examination we may follow a procedure somewhat like this. The various experiments in practical/laboratory/field work are to be listed as content areas and abilities like knowledge/skill/abilities listed as ability dimension and a table of specifications prepared. To improve the reliability, a combination of continuous assessment and end examination can be thought of and also abilities/skills that are to be assessed by both decided earlier. It is also felt that traditional laboratory sheets giving aim,procedure results,conclusions and reports based on this tend to encourage copying from only one student who performs the work in the laboratory/field. In its place increasing use of laboratory sheets involving questions (answers) on an individual basis or programmed instruction material for handling instruments (in performing experiments) must be made to really make laboratories a learning place.

The present numerical marking system in the practical/laboratory/field work provides a very inaccurate measurement of academic achievement. The marking system does not use the full range of marks 0 to 100 everywhere. A range of 20 to 55 is very common in history, Commerce and Psychology etc. The highest marks obtained by an outstanding student in mathematics is nearly 100; an equally outstanding student of history gets somewhere about 58 which is not a first class mark since very often 60% and above is cur arbitrary first class. So it happens that in certain subjects students cannot get a first class however outstanding their performance may be. If we adopt a sound grading system in the place of marks most of the things mentioned above will be taken care of. It will be readily appreciated that if all universities adopt the same grading system and interpret it in the same way, the students can easily move from one university to another within a state or from one state to another. This is advisable and also desirable from the point of view of national integration. The grading system may be 3 point scale, 5 point scale, 7 point or 9 point scale. However, the grading system recommended is the 7-point scale from O - A - B - C - D - E - F, representing outstanding, very good, good, average below average, poor, very poor respectively. It is also highly recommended that 'Direct Grading' may be resorted to in assessing practical/laboratory/field work.

Fundamental criteria to design the laboratory examinations

1. They should pose some real and intrinsically valuable problems to the students.

2. It should be possible to perform the task and conclude the investigation within a reasonable time limit.

3. The problems should be novel to the examinees, but the level of difficulty and the required skills should be compatible with the objectives of and the experiences provided by the curriculum.

4. Since it would be impractical to administer the test individually, it should be administered in a group setting. Since every student will be able to perform only one full investigation, several different problems must be used simultaneously to ensure independent work within this group setting. However, for the sake of comparability the different tests should be convergent on a number of skills with specific weights given to the various responses. It will also be necessary to control for differences in the levels of difficulty as well as for the heterogeneity of variance by employing appropriate statistical moderation procedures.

5. The students performing a complete investigation may encounter certain difficulties at various stages in his work. It is inconceivable that he should fail in the whole examination just because, for instance, he made some incorrect observations. Therefore, a procedure is needed for prompting or providing certain leads during the examination without damaging the standard of assessment.

6. Since the tests are based on open ended problems, measures of divergence are needed, but acceptable limits of this divergence must still be set.

7. When tests of this kind are used as external examinations, special logistic problems are involved. For example, while certain materials and laboratory equipments can be prepared by the schools, some materials and organisms must be brought by the examiner in order to prevent the examinees from obtaining cues regarding the task to be assigned during the examinations. Also since novelty is an important feature, new problems must be designed every year.

8. A table of specification for a practical/laboratory/field work examination at the end of a course of study can be as follows:

Abilities Content	Weightage	Knowledge	Skill	Ability
Chain survey	15%	6%	6%	3%
Compass survey	15%	5%	6%	4%
Plane table survey	15%	4%	7%	4%
Levelling	40%	10%	20%	10%
Theodolite Survey	15%	6%	6%	3%
Total	100%	31%	45%	24%

The final field work examination can consist of questions, one each of:

Chain Survey
Compass Survey
Plane table Survey
Theodolite Survey, and

two questions in levelling. The table also indicates that the total maximum for practical test is 100 of which chain survey question carries 15 marks, compass survey question carries 15 marks, plane table survey question carries 15 marks, levelling question carries 40 marks and theodolite question carries 15 marks.

The question on chain survey may consist of (1) six simple items to check the student's knowledge of instruments, methods, ways of using apparatus and of limitations of instruments; and (2) field work to require the student to measure the distance between the given two pegs at site and may include sometimes measuring a couple of offsets on either side and to ask to produce a drawing to scale. A practical/laboratory/field work examination of this kind is more meaningful and valid. Validity is being built into it and the test is likely to be more reliable than a conventional examination.

SECTION VIII

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APPENDIX A

MODEL PRACTICAL TESTS

MODEL PRACTICAL TEST IN SURVEYING

I

1. Engineer's chain given for measurements consists of

   a. 100 links of 1 foot each
   b. 66 links of 1 foot each
   c. 100 links of 0.30 m each
   d. 100 links of 1 m each

☐

2. You are asked to set out right angles to the chain line. The instrument you will use is:

   a. Trisquare
   b. Ranging rod
   c. Alidade
   d. Optical square

☐

3. List the equipment needed to measure a chain line of nearly 100 m length with 30m chain.

4. What is the normal accuracy of measurement with a chain?

Total 6 marks

Figure shows certain area of your Institute. You are required to measure the line marked PQ with an Engineer's chain. You are also required to locate the corners of buildings on either side by taking offsets, by means of a tape.

Record your observations in a suitable form

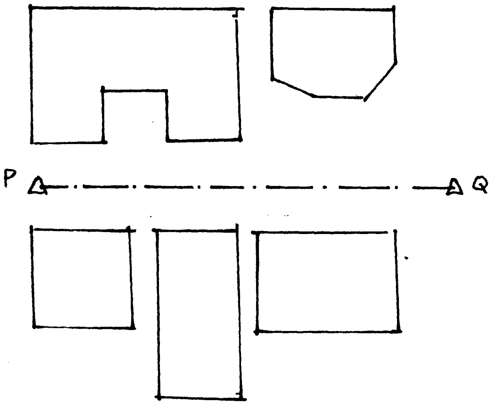

FIG 1

9 marks

II

1. The needle of a magnetic compass will be

   a. in a horizontal plane east-west direction
   b. in a vertical plane passing through the compass and the magnetic pole
   c. in a vertical plane passing through the compass and the true north direction
   d. none of the above.

☐

2. List the three types of compasses in use.

3. Local attraction is due to:

   a. The needle dipping down
   b. The needle being pulled out of its normal position

c. Needle moving from east to west
d. Needle moving from north to south

☐

4. Do you expect your Institute area to have local attraction? Figure 2 shows two lines AB, BC laid out in the field. You are required to make use of a prismatic compass and find the magnetic bearings of lines AB, BC. Record your observations in a suitable form. Find included angle ABC.

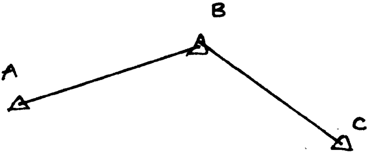

FIG 2

10 marks

III

1. Name two methods.

Figure 3 shows three ranging rods with flags AB and C. You are required to take a base PQ and measure its length. You are required to set up the plane table at P and Q and by a suitable method plot A, B and C, Measure the distance AB and BC.

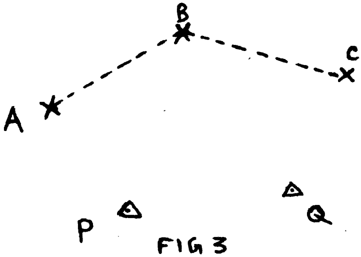

FIG 3

11 marks

IV

1. List the two kinds of telescopes that are normally used in a level.

2. Name two important temporary adjustments you will do at every set up of level.

3. Sketch below the diaphragm of your level with the cross hairs marked.

4. With a level, it is possible to:

   a. measure horizontal angle
   b. measure vertical angle
   c. measure both horizontal and vertical angle
   d. measure difference in elevation between two points.

☐

5. Back sight is defined as

   a. sight taken back on a staff
   b. reading on a staff placed on a point of known elevation
   c. last reading on a staff at a particular set up level before it is shifted.
   d. reading of staff placed at a point whose elevation is to be determined

☐

6. Name two methods of reduction of level of points

10 marks

A, B, C, D are four points as described below:

A. is top of the step in building (1)
B. is the bottom of the canopy in building (2)
C. is the top of parapet of culvert
D. is the top of manhole near building
E. is a point of known elevation = 50:000 m.

You are required to run fly levels and find elevations of A, B, C and D.

Record in a suitable form. Adopt the height of collimation method for reduction.

15 marks

Area Opposite the Hostel building of the Institute is undulating. Pegs are driven at the corners of 16 points all of them forming 10 m. x 10 m squares.

You are required to find the levels of these 16 points in relation to a point P whose elevation is known to be +25. 000 m. Record your results in a suitable form. Produce, by drawing to a scale of 1 cm = 1m.

Contours at intervals of . 5 m
Comment on the nature of the area

15 marks

V

1. A theodolite is different from a level in that

   a. theodelite can enable one to find horizontal angles while level cannot.
   b. theodolite can enable one to find vertical angles while level cannot
   c. theodolite can enable one to find both horizontal and vertical angles while level cannot.
   d. none of the above

☐

2. Name two types of theodolites you know

3. The lower plate screw and its tangent screw serve function of:

   a. fixing up the theodolite so that it cannot be rotated about a vertical axis.
   b. fixing up the theodolite so that it cannot be rotated about both horizontal and vertical axes

c. finding vertical angle between two points
d. finding the horizontal angle between two points

6 marks

4. How do you focus the eye piece ?

A, B and C are three points as described below

A is the tip of Traingulation signal erected at the first floor level Building (1).
B. is the top of a flagmast
C is the peg over which theodolite is to be set up by you.

Set up the theodolite at C and do all temporary adjustments. Make observations to A and B and find included angle, ACB and vertical angles to A and B. Record in a suitable form.

9 marks

3.00. Practical Examination in Surveying

A group of polytechnic teachers who assembled at the Technical Teachers Training Institute in the Summer of 1970 to produce objective type tests in surveying reviewed the various sources and produced the following General Educational objectives:

1.00	Knowledge
2.00	Understanding
3.00	Application
4.00	Ability to make observations
5.00	Synthesis

6.00 Evaluation
7.00 General Skills

- a. Manual - handling instruments with ease and making observations
- b. Reading - charts, tables and graphs
- c. Drawing - maps, graphs and sketches
- d. Computing
- e. Communicating.

8.00 Interest in Surveying
9.00 Positive attitude to surveying
10.00 Scientific attitude through study of surveying
11.00 Scientific appreciation of surveying

The group also produced a Table of Specifications indicating abilities or behaviours likely to be developed in Laboratory work/Field work.

Test or Exam. for field work must assess the following:

1.00 Knowledge	of instruments of methods/procedures of ways of using apparatus of limitations of instruments
2.00. Skill	in handling instruments with ease in making observations in handling data and computing
3.00 Ability	to observe, make measurements to record to draw conclusions to write a report or communicate in an acceptable form to devise novel procedures and solve a problem.

4.00. Table of Specifications

A table of Specifications for field work exam. at the end of a course of study can be

Abilities content	Weightage	Knowledge	Skill	Ability
Chain Survey	15 p.c	6 p.c.	6 p;c.	3 p.c.
Compass Survey	15 p.c.	5 p.c.	6 p.c.	4 p.c.
Plane Table Survey	15 p.c.	4 p.c.	7 p.c.	4 p.c.
Levelling	40 p.c.	10p. c.	20 p.c.	10 p.c.
Theodolite Survey	15 p.c.	6 p.c.	6	3 p.c.
Total	100 p.c.	31 p.c.	45 p.c.	24 p.c.

The final field work examination can consist of questions one in each of

Chain survey
Compass Survey
Plane Table Survey
Theodolite Survey and

two questions in levelling.Table also indicates that the total maximum for practical test is 100 of which

Chain survey question carries 15 marks
Compass Survey question carries 15 marks
Plane Table question carried 15 marks
Levelling question carries 40 marks
Theodolite question carries 15 marks

The question on chain survey may consist of (1) six simple items to check the student's knowledge of instruments, methods ways of using appratus and of limitations of instruments and (2) field work to require the student to measure the distance between the given two pegs at site and may include sometimes measuring a couple of offsets on either side and to ask to produce a drawing scale.

A model Laboratory/Practical Test to be used at the end of a course of study in surveying is given in the appendix A. This practical test consists of six questions each question to be finished in 1/2 hour. The questions on levelling carry 40 marks and the rest 15 marks each.

5.00 Conclusion

A field work examination of this kind constructed is more meaningful and valid since the abilities and content are considered in the Table of Specifications. Validity is being built into it and the Test is likely to be more reliable than a conventional examination. It is quite possible to think and include job oriented problems of surveying in this kind of test bringing in vocational relevance, so vital and necessary in technical teaching and testing.

MODEL PRACTICAL TEST IN ZOOLOGY

A model laboratory/practical test to be used at the end of a course of study in Zoology at graduate level is given below. The test will be of 3 hour duration with a variation of marks and time for each item.

Q. No. 1. Dissect out any one of the following parts of the given animals:

a. Salivary glands of the Cockroach.
b. Ovaries of the earthworm
c. Mouth parts of the cockroach
d. Ring system of earthworm

Marks 15 Time 30 minutes

Q. No. 2. Mount the important parts of any of the following system

a. Arterial system of the frog
b. Venous system of the frog
c. Nervous system of scoliodon.
d. Excretory system of the frog
e. Reproductive system of the frog

Marks 40 Time 80 minutes

Q. No. 3. List out the names of the bones provided to you with a specification of their locations inside the bodies' of the various animals.

Marks 10 Time 30 minutes

Q. No. 4 Prepare a slide of your own blood and count the number of R. B. Cs.

Marks 10 Time 20 minutes

Q. No. 5. Identify ten mirco slides of the various parts of animals within the duration of ten minutes.

Marks 10 Time 10 minutes

Q. No. 6. Record and Viva-Voce

Marks 15 Time 10 minutes

MODEL PRACTICAL TEST IN BOTANY

A model laboratory practical test to be used at the end of a course study in Botany at graduate level will consist of 3 hour duration with a variation of marks and time for each item.

Q. No. 1. Compare and contrast the T. S. of a stem with the T. S. of a root. Discuss and draw the diagrem for the same.

Marks 30 Time 60 minutes

Q. No. 2. Prepare a slide of stomata from the green leaves and explain the functions of stomatae with diagramatic representation.

Marks 10 Time 20 minutes

Q. No. 3. Prepare a slide of the reproductive parts of CHARA and explain.

Marks 10 Time 25 minutes

Q. No. 4. Identify and explain the provided section of a stem/root with diagramatic representation.

Marks 15 Time 35 minutes

Q. No. 5. Identify the given plants with their names, families and species, and also identify the provided slides (spotting)

Marks 20 Time 20 minutes

Q. No. 6. Collection of herbarium sheets, Record and viva-voce.

Marks 15 Time 20 minutes

MODEL TEST IN CHEMISTRY

MODEL PRACTICAL TEST IN CHEMISTRY

A model laboratory practical test to be used at the end of a course study in chemistry at graduate level will consist of 6 hour duration with a variation of marks and time for each item.

Q. No. 1. Mixture Analysis: Find out the acidic and basic radicals from the given misture

Marks 50 Time 150 minutes

Q. No. 2. Volumetric Analysis: Titration of an acid with a base using phenolpthaline as an indicator.

Marks 20 Time 60 minutes

Q. No. 3. Gravimetric Analysis:

Marks 25 Time 60 minutes

Q. No. 4. Preparation of uric acid with the help of urea.

Marks 25 Time 40 minutes

Q. No. 5. Estimation of the boiling point of a liquid organic compound.

Marks 20 Time 40 minutes

Q. No. 6; Record & Viva-voce

Marks 15 Time 10 minutes

APPENDIX B

A COPY OF QUESTIONNAIRE

RESEARCH CELL
ASSOCIATION OF INDIAN UNIVERSITIES
NEW DELHI

QUESTIONNAIRE

PRACTICAL EXAMINATION — STAGE III

The Research Cell of the Association of Indian Universities is engaged in exploring a rational method of Practical Examinations for university courses in our country. This questionnaire is mainly intended to solicit the views of University teachers on certain important issues concerning practical examinations with a view of providing a rational and scientific design. This document is divided into three sections:

Section I	A short note on Practical examinations
Section II	Biodata of teachers
Section III	Questionnaire soliciting views

The information supplied by teachers, will be used to produce a Monograph on Practical Examinations, incorporating the views of teachers and providing a design of Practical Examination for various courses.

SECTION I

A NOTE ON PRACTICAL, LABORATORY AND FIELD WORK

One of the most interesting features in Teaching/ Learning in Higher Education in our country has been the tradition of Practical/Laboratory/Field work carried out by students either individually or more commonly in small groups; this characteristic has been particularly evident in respect of the teaching of science subjects; Practical/Laboratory work has been seen to constitute an important element in the Teaching/Learning process and the development of Practical/Laboratory skills has been established as an important desirable outcome of courses in many subjects. While Practical/Laboratory work is inherent in many science and professional courses (engineering, technology & medicine) field work seems to be an important component of social and human sciences. This note is intended to introduce Practical/Laboratory/ Field work, its purposes, objectives, methods of assessment etc. so that responses to various questions in the questionnaire that follows can be made in an informed way.

It is important to appreciate that the purpose of Practical/Laboratory/ Field work various from subject to subject and that there can be a variety of purposes within an individual subject. For instance some Practical/Laboratory work will be carried out in a teaching course with the purpose of introducing, developing or reinforcing theoretical concepts; such work might be regarded as being of importance in the Teaching/Learning process but as being relatively unimportant in terms of the skills whose development is a major objective of the course. Practical/Laboratory work in the form of personal studies or 'projects' (individual or group) and certainly examples of work found in 'learning by discovery' situations all fall into this category. Their inclusion in any course of study, can, for example, provide opportunities to develop student understanding of the particular aspects of the subject and demonstrating those practical skills necessary to undertake the work. Some subjects are often described as being 'practical subjects' like art, craft subjects like needlework, dressmaking, cookery, wood work, metal work etc. This means that one of the major educational objectives of the course is the acquisition and development of certain practical skills. It may also mean that some subjects are practical or laboratory based (Physics, Chemistry, Biology, Electronics etc.) In all these cases, practical/laboratory work is of importance in establishing & illustrating the theoretical aspects of the subject as well as developing necessary and desirable skills which all students of the subject should possess. If Practical/Laboratory/Field work is to be assessed, then the assessment should be concerned with measuring those skills and abilities which are important and not only that, those that are developed in students. Before attempting to assess Practical/Laboratory/ Field work, we have to satisfactorily identify what is to be measured.

Practical/Laboratory/Field work is often regarded as being the DOING activities rather than the KNOWING qualities of students, but it is not as simple as this. It is as varied as are those purposes of practical work. Much Practical/ Laboratory/Field work must involve the application of knowledge, the use of theoretical concepts and more open ended practical investigations rather than routine practical operations. The interrelationship in any subject between theory and practice must be studied and taken into account in assessment procedures. In fact much of the work relating to examination reforms in Higher Education had so far been confined to improvement of questions for written tests and practical work and practical questions have attracted far less attention. Bloom, Ebel, Scriven, Gagne and others in the field of educational measurement greatly influenced the design of written examinations; such work in the area of objectives of Practical/Laboratory/Field work is appearing here and there.

The specification of objectives of assessment is the most crucial aspect in designing assessment procedures for practical/laboratory/field work. The question of deciding schemes internal and external assessments in a subject is only a matter of matching the objectives; their mode of development and the feasibility of answering or measuring the attainment of them. While there are a good number of sources of objectives of Practical/Laboratory/Field work, those that are produced by the Leicester School of Education can be quoted here as very useful.

1) Ability to use simple apparatus and implement simple procedures.

2) Ability to observe changes/differences in structures of systems under investigation and to record such changes/differences in ways which yield maximum relevant information.

3) Ability to select appropriate apparatus and/or procedures for a new experimental problem.

1.10 Knowledge of instruments/apparatus.

1.20 Knowledge of procedures.

1.30 Knowledge of ways of using instruments/apparatus.

1.40 Knowledge of limitations of instruments/apparatus.

2.10 Ability to use appratus/instruments.

2.20 Ability to implement procedures.

2.30 Ability to select appropriate procedures/methods for a particular problem.

3.10 Ability to observe the structures or systems under investigation.

3.20 Ability to observe changes/differences in the dimensions of the structures or systems under investigation.

3.30 Ability to record appropriately the observed structure or system and the changes occuring in it.

3.40 Ability to handle data of tests/field work and interpret.

4.0 Ability to write report or communicate results in an acceptable form.

5.0 Ability to draw conclusions.

6.1 Ability to devise new apparatus to meet the demands of a practical problem.

6.2 Ability to devise novel procedures to solve a practical problem.

Generally speaking Practical/Laboratory/Field work of one kind or the other in various subjects, involves among other things, the following five major things:

I Skill in observations and recording of observations. These include practical/experimental/field data

II Ability to interpret and assess the results of practical/laboratory/field data

III Ability to plan practical procedures and techniques for solving particular problems.

IV Manipulative skills

V Attitudes to Practical/Laboratory/Field work including such attributes as persistence, enthusiasm, originality and enjoyment.

The success of any scheme of assessment depends upon the quality of the instruments of assessment that are used. The stated objectives must be validly & reliably measured; the assessment procedure should not make unreasonable demand upon the available resources such as administration, manpower, finance, time etc., and finally the nature of assessment should not distort the educational process.

I Skill in observation and the recording of observations:-

Here the purpose of assessment is to measure the extent to which, in any given situation, the student observes those things that should be observed and makes appropriate recordings in order that he can subsequently evaluate the results of these observations. These may be for 'verification' type as well as 'investigation' type of experiments or practical work. Students can be presented with specific operation either as demonstrations or as exercises to carry out themselves and be required to make records of these. Both oral reporting as well as written reporting are possible. Some times all that is there in an observation is to be given while very many times the student's ability to identify important and relevant features will be involved.

This major objective can be a component of continuous internal evaluation and also form part of external, end examination.

II Ability to interpret and assess the results of Practical/Laboratory/Field work data:-

Here the purpose of assessment is to measure the extent to which the student can evaluate the results obtained by Practical/Laboratory/Field work. The student may have to carry out calculations, identify unknowns to determine particular characteristics of material under investigation, draw graphs, charts and perhaps make meaningful interpretations. Drawing conclusions or providing an explanation is definitely involved. The correctness of this of course will depend upon the accuracy with which observations were made. The question of combining the correctness of observations and the consequent correctness of inter pretations may be quite relevant in continuous internal evaluation and therefore an end, external examination will find it difficult to do both at the same time.

III Ability to plan practical procedures and techniques for solving particular problems:-

The purpose of assessment is to measure the extent to which the student is able to plan a procedure for practical/laboratory/field work. A practical problem within the student's competence may have to be presented and the student will be required to evolve an appropriate method of solving it. A new situation requiring basic procedures known to the student, yet involving the student to choose, appropriately is what is intended. Routine 'verification' type of experiments/exercises in laboratory will fail to develop the ability as well prove to be inadequate for testing this ability. Investigation type of experiments requiring students so to say to do on their own experiments/exercises will certainly help the students to develop this ability and hence test these abilities. Continuous internal evaluation is much more meaningful than an end practical/laboratory examination.

IV Manipulative skills

The purpose of the assessment is to measure the extent to which the student can carry out the range of manipulative skills intended to be developed. Practical/ Laboratory examinations mostly assume that manipulative skills are being measured by exercises/experiments in which the student is required to perform specified operations and report results. There is a danger however that the student's mastery of specific skills may be hidden in the overall result obtained. Manipulative skills are always best assessed in situations in which the specific skill can be isolated for attention. Continuous internal assessment where the assessor can actually observe student's actions and assess, is much more meaningful than external examination involving a good number of students at a time.

V. Attitudes towards practical work

Here one is concerned with such things as student's approach, the extent to which he accepts the practical approach, the scientific & positive attitude to report observations as such without cooking up, etc. Attitude measuring scales are to be constructed and grading on a 5 point scale can be done. Here continuous internal assessment by the teacher making use of an attitudinal scale is much more meaningful and valid.

S. Number	Description	5	4	3	2	1
1.	Admires good students, teachers of the subject & literature.					
2.	Is ready to undertake practical work					
3.	Is ready to undertake tests					
4.	Examines every detail in the Practical/Laboratory problem					
5.	Seeks fresh clues beyond the ones known					
6.	Reports observations without working up (cooking)					
7.	Accepts mistakes without reservations					
8.	Is ready to experiment again					
9.	Sticks to the practical/ laboratory/field problem and never leaves it unsolved					
10.	Takes pleasure in doing practical/laboratory/field work.					

The various methodologies include set exercises, project work, course work, oral questioning and assessment by impression. In Practical/Field/Laboratory work, general approach, technique, accuracy, interpretation and conclusion & report are all involved and they form heads of assessment. Either 25 marks per experiment/laboratory exercise/field work can be allotted with General Approach (4), Technique (4) Accuracy (5), Interpretation (6) and Conclusion and Report (6) or these can be graded using a 7 point scale. It is felt that traditional laboratory sheets/ practical work instruction sheets giving aim, procedure, results, conclusion and reports based on this tend to encourage copying from only one student who performs the work in the laboratory/field. In its place, increasing use of laboratory sheet involving questions/answers on an individual basis or programmed instruction material for handling instruments/performing experiments must be made to really make laboratories, a learning place. It is also felt that laboratory work/practical work/field work, in order to develop the kind of skills/abilities desired, must be made up of "verification" as well as "investigation" types of exercises/experiments.

This really means that certain experiments can be performed by students in an 'investigation type without even knowing the theory behind. These investigation experiments are so carefully planned that students will be led to discover, as it were, certain things which are not since then taught to them. In addition, there is another value in it; this kind of investigation develops certain abilities/skills of experimentation, innovation, discovery that there is overall satisfaction leading to better motivation on the part of students.

It is intended that teachers will respond to the various questions in this questionnaire and all responses of teachers from every discipline put together, analysed and consolidated. It is hoped that in every discipline/subject area objectives of Practical/Laboratory/Field work; methods of providing experiences in Practical/Laboratory/Field work and above all methods of assessment of Practical/Laboratory/Field work will emerge.

SECTION II

BIO-DATA OF TEACHER

2.1 Name of Teacher ______________________

2.2 Name of College ______________________

2.3 Name of University ______________________

2.4 Subject of Specialization ______________________

2.5 Courses taught: at your institution.

I At first degree level

	I	II
1. Physics	☐	☐
2. Chemistry	☐	☐
3. Zoology	☐	☐
4. Botany	☐	☐
5. Mathematics	☐	☐
6. Psychology	☐	☐
7. Geography	☐	☐
8. Economics	☐	☐
9. History	☐	☐
10. Commerce	☐	☐
11. Sociology	☐	☐

II At post graduate level

	I	II
12. Pol. Science	☐	☐
13. English Language	☐	☐
14. Other Language	☐	☐
15. Engineering	☐	☐
16. Medicine	☐	☐
17. Agriculture	☐	☐
18. Law	☐	☐
19. Library Science	☐	☐
20. Vet. Science	☐	☐
21. Other Subjects (Specify)	☐	☐

2.6 No. of years of teaching
Graduate Level ______________________
Post Graduate Level ______________________

2.7 Are you involved in teaching practical/laboratory/field courses Yes ☐ No ☐

If 'yes' give details of your present practical/laboratory/field courses regarding its nature:

____

____

____

SECTION III

QUESTIONNAIRE

This questionnaire designed to solicit the views of teachers in Practical/ Laboratory/Field work in various disciplines is divided into major classes viz.

A. Scope and the nature of Practical/Laboratory/Field Work.

B. Objectives of Practical/Laboratory/Field Work.

C. Assessment methods for Practical/Laboratory/Field Work.

D. End external examination and continuous assessment.

E. Design of assessment procedures for Practical/Laboratory/ Field Work.

F. Marking versus Grading for Practical/Laboratory/Field Work.

A. Scope and the Nature of Practical/Laboratory/Field Work.

Below is given a list of items regarding the scope and the nature of practical/ laboratory/field work. You are to read every item and put a tick mark inside the box ☐ The five points scale, used here, consists of five boxes which represent responses, Verymuch agree, Agree, Uncertain, Disagree and Very much disagree respectively. You have to respond to all the items.

1. Practical/Laboratory work gives the training to handle sophisticated apparatus and thus develops technical skills of handling instruments.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

2. Practical/Laboratory work involves basic knowledge regarding the functions of apparatus.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

3. Practical/Laboratory work gives the basic knowledge to a student regarding the construction of the apparatus. (leading to preparation of improvised apparatus).

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

4. Practical/Laboratory work gives the knowledge of trends and methodology

of the exercise/experiment.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

5. The concept of "learning by doing" is inherent in practical/laboratory field work.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

6. Practical/Laboratory/Field work helps to demonstrate and reinforce the principles set out in theoretical lectures.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

7. Practical/Laboratory/Field work enhances the theoretical knowledge and practical skill as both are complementary to each other.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

8. Practical/Laboratory/Field work gives experience in operating and testing instruments.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

9. The development of practical skills have been established as an important desirable outcome of teaching.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

10. Practical/Laboratory/Field work is carried out in a teaching course with the purpose of introducing, developing or reinforcing theoretical concepts.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

11. Practical/Laboratory/Field work is often regarded as activities for doing rather than the knowing.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

12. Practical/Laboratory/Field work involves the application of knowledge and the use of theoretical concepts.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

13. Practical work given in the form of projects can also be designed to serve the same purpose. In addition (individual) projects help to bring out the problem solving skills of individuals; group projects in addition help students to work as a team (a very near life situation).

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

14. Practical/Laboratory/Field work familiarizes the students with the methods of collecting experimental/field data.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

15. Practical/Laboratory/Field work gives training in methods of analyses and interpretation of data.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

16. Practical/Laboratory/Field work gives the training for the preparation of scientific and technical report.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

17. Practical/Laboratory/Field work develops the ability to make a judgement and evaluate data and information.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

18. In the practical/Laboratory/Field work, skill in handling instruments and use of them is learnt effectively by repetition.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

19. Practical/Laboratory/Field work leads to the development of the ability and resourcefulness in planning & executing projects.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

PRACTICAL LABORATORY/FIELD WORK

Usually practical work involves 'skill learning' by repetition. The learning is in stages and it requires careful planning of practical exercises. The final objective will be to gain mastery of the skill. Wood work, fitting, smithy, machining, handling instruments, measuring relate to engineering; dissection, examining blood, urine etc., surgery relate to medicine; handling instruments, manipulating, observing, recording relate to basic sciences; collection of data, recording, tabulating, drawing graphs, charts, maps relate to social sciences.

20. In your subject area practical work is relevant.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

21. In your subject area already practical work is planned and available. This is of course inadequate.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

22. In your subject area additional practical work can be planned.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

23. The time allotted for practical work is sufficient.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

24. Do you think that the skill to be learnt in Practical work is to be demonstrated?

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

Laboratory work

In the laboratory, a series of 'experiments' are to be performed by students to develop skills of handling instruments, manipulating, observing, recording, drawing, sketching skills together with ability to analyse data, find and infer and write a report and so on. Usually experiments are of two kinds, one those that get the students to verify the theory and principles known already, and the other those that get students to learn by doing without a knowledge of the theory behind. While the former is the routine, traditional verification, type of experiments, the latter is called 'investigation experiment that promote a kind of 'discovery learning'.

25. In your subject area laboratory work is relevant.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

26. In your subject area laboratory work is planned and available. This is of course inadequate.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

27. In your subject area additional laboratory work can be planned to develop skills of handling instruments, manipulating, recording and to infer and write a report and so on.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

28. The time allotted for laboratory work is sufficient.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

29. Do you think that the skill to be learnt in the laboratory is to be demonstrated?

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

Field work

In the field work, the ability to collect relevant data and information in the study of a problem either individually or in a small group, is important. Individual or group projects can be given. In addition to the development of the ability to collect data, record and use it, ability to work in a team, to develop leadership qualities are developed in students.

30. In your subject area field work is relevant.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

31. In your subject area, already field work is planned and available. This is of course inadequate.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

32. In your subject area field work can be planned.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

33. The time allotted for the field work to collect relevant data and information is sufficient.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

34. Do you think that the skill to be learnt is to be demonstrated in field work?

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

B. Objectives of Practical/Laboratory/Field work

Below is given a list of objectives collected from different sources. Against every statement, enter with a tick mark ☑ in the first box if it applies to your discipline of practical/laboratory/field work and in the second box, give a rank order to all your selected statements with the actual number written in the second box; For example, ☑ [illegible] This will mean, that the item applies and that you give a rank of 4 to it. The following are the objectives of practical/laboratory/field work.

	Practical work		Laboratory work		Field work	
1. Investigation of theoretical principles and concepts, and their applications.	☐	☐	☐	☐	☐	☐
2. Appreciation of measurements and measurement techniques.	☐	☐	☐	☐	☐	☐

		Practical work		Laboratory work		Field work	
3.	To demonstrate a basic law & to verify the correctness of theoretical calculations.	☐	☐	☐	☐	☐	☐
4.	Appreciation of instruments and equipment design.	☐	☐	☐	☐	☐	☐
5.	Appreciation of experimental technique i. e. stipulation of a problem and the devising of best means and procedures for economic solution.	☐	☐	☐	☐	☐	☐
6.	To establish a mathematical relationship between variables.	☐	☐	☐	☐	☐	☐
7.	To teach the use of certain machines.	☐	☐	☐	☐	☐	☐
8.	Development of individual and group discussion abilities.	☐	☐	☐	☐	☐	☐
9.	To teach the use of certain machines and the way to test a machine.	☐	☐	☐	☐	☐	☐
10.	Development of visual communication, sketching of apparatus and graphs etc.	☐	☐	☐	☐	☐	☐
11.	Development of techniques of recording and reporting.	☐	☐	☐	☐	☐	☐
12.	Development of team techniques working as a team.	☐	☐	☐	☐	☐	☐
13.	Development of ability to follow instructions.	☐	☐	☐	☐	☐	☐
14.	To develop the insight in planning and executing projects.	☐	☐	☐	☐	☐	☐
15.	Development of the basic knowledge regarding the construction of the apparatus (leading to preparation of improvised apparatus.)	☐	☐	☐	☐	☐	☐

		Practical work		Laboratory work		Field wor
16.	To demonstrate and reinforce the principles set out in theoretical lectures.	☐	☐	☐	☐	☐ ☐
17.	To enhance the theoretical knowledge and practical skill as both are complementary to each other.	☐	☐	☐	☐	☐ ☐
18.	Development of the activities for doing rather than knowing (a concept of learning by doing)	☐	☐	☐	☐	☐ ☐
19.	Practical/Laboratory/fieldwork involves the application of knowledge and the use of theoretical concepts.	☐	☐	☐	☐	☐ ☐
20.	Individual projects help to bring out the problem solving skills of individuals, whereas group projects help to work as a team.	☐	☐	☐	☐	☐ ☐
21.	To develop the insight for collecting, analysing and interpreting the data.	☐	☐	☐	☐	☐ ☐
22.	Development of the abilities to make a judgement and evaluate data and information.	☐	☐	☐	☐	☐ ☐
23.	Development of the ability and resourcefulness for the preparation of scientific and technical reports.	☐	☐	☐	☐	☐ ☐
24.	Development of the level of knowledge of units, limitations of instruments, and ways and means of using apparatus and instruments.	☐	☐	☐	☐	☐ ☐
25.	Development of the ability to draw conclusions and inferences.	☐	☐	☐	☐	☐ ☐
26.	Development of the ability to produce or reproduce the knowledge which a student has acquired by reading the books.	☐	☐	☐	☐	☐ ☐

C. Assessment methods for Practical/Laboratory/Field work

1. The present modes of the assessment of practical/laboratory/field work are inefficient and traditional in which there is no innovation.

   ☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

2. Since we use the same experiments for the practical/laboratory/ field work year after year, there is a tendency for students to borrow the practical/ laboratory/field work note books form students of earlier years.

   ☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

3. The assessment procedure for practical/laboratory/field work is very much biassed. The students having good rapport with their teachers secure better marks/grades.

   ☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

4. An end practical/laboratory/field work examination (at the end of a year or semester) suffers from poor content validity.

   ☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

5. In the final practical/laboratory examination, there is a 'chance factor' in that student has to pickout a number of an experiment/practical for the examination. It may well happen that a student may land up with the one that he had not performed.

   ☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

6. Since a large number of students are examined in a limited time it becomes a problem for the examiners to make a real assessment of the abilities.

   ☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

7. Since the end practical/laboratory examinations are conducted in different batches and a fixed number of laboratory test questions are repeated for every batch with a minor variation of data, the content validity is very low for this.

/____/	/____/	/____/	/____/	/____/
Very much agree	Agree	Uncertain	Disagree	Very much disagree

8. During the time the students are busy with their experimental work, the examiners go around for examining each student orally and thus divert their attention.

/____/	/____/	/____/	/____/	/____/
Very much agree	Agree	Uncertain	Disagree	Very much disagree

9. Examiners generally ask few questions unrelated to the experiment/practical at the examination which may not be answered by the students and the separate assessment is usually based on the number of correct answers given by the students.

/____/	/____/	/____/	/____/	/____/
Very much agree	Agree	Uncertain	Disagree	Very much disagree

10. In a few institutions, due to lack of adequate laboratory facilities the candidates are not required to carry out any practicals and the assessment is made on the basis of the relationship between the teacher and the student.

/____/	/____/	/____/	/____/	/____/
Very much agree	Agree	Uncertain	Disagree	Very much disagree

11. During the oral testing in the practical/laboratory examinations the examiners generally ask the same questions to every student.

/____/	/____/	/____/	/____/	/____/
Very much agree	Agree	Uncertain	Disagree	Very much disagree

12. In the present day practical/laboratory examinations the scores do not cover a wide range e.g. the range of marks is usually in between 60% to 90% and thus it becomes difficult to discriminate between excellent and poor students.

/____/	/____/	/____/	/____/	/____/
Very much agree	Agree	Uncertain	Disagree	Very much disagree

13. Many times it happens during the practical/laboratory examination that a student has to do such an experiment which he missed during the academic year due to some unavoidable circumstances and thus becomes helpless at that time. The content validity of the end practical/laboratory examination suffers on account of this.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

14. In practicals generally the results of the experiments/practicals are to some extent known to students so that the ability of application in a practical situation is never tested.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

15. In certain other practicals experiments few students have already been told by the teachers regarding the questions (e.g. dissection of animals and the parts to be mounted) so that students come prepared (carry these parts to the laboratory/examination hall) and get undue credit.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

16. Since there is no option for the students to select the experiments in the practical/laboratory examination and the student is supposed to do the given experiment only. This procedure not only lacks content validity but depends on "Chance factor".

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

17. In the practical/laboratory examination the assessment is made on the view of the external & internal examiners. But it has been the general practice that the marks are decided more often by the internal examiner and therefore favouritism is likely to be shown by the internal.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

18. The practical/laboratory work can be assessed by the help of set exercises/experiments/field work:

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

19. The practical/Laboratory/Field work can be assessed through the project work.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

20. The practical/ laboratory/field work can be assessed by measuring agreed qualities over the whole of the course followed by the student.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

21. The practical/laboratory/field work can be assessed on the basis of the practical note books, home work & class work records.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

22. The practical laboratory work can be assessed by oral questioning.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

23. Practical/laboratory work can be assessed by the personal impression during the normal conduct of laboratory work.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

D. End External Examination & Continuous Assessment

The practial/laboratory/field work may be assessed either externally or internally. Below is given a list of items regarding the advantages and disadvantages of external and internal assessment. You have to respond to all the items accordingly.

1. External assessment provides an independent assessment whose results are most likely to be accepted by the users of examination results.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

External assessment provides for uniformity of practice and standards with all students being assessed upon common qualities by common criteria.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

3. External assessment concentrates resources and expertise for setting and marking.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

4. External assessment obviates the possibility of any conflict arising between the teacher as a teacher and the teacher as an assessor.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

5. External assessment provides an assessment procedure unaffected by personal relationships between teacher and students.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

6. The means of external assessment are limited to those which can be administered by an external agency.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

7. The external assessment may exercise a restricting influence upon the practical/laboratory work carried out in institutions/colleges.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

8. The external assessment is limited to the outcomes of practical work and does not include a consideration of how the work is carried out.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

9. The number of occasions upon which the external assessment can take place is limited for administrative reasons.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

10. In the Practical/Laboratory work, the danger of chance failure or success in the internal assessment are decreased by making assessment possible on a number of occasions.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

11. During the internal assessment of practical/laboratory work, a wide variety of means of assessment may be used covering a wide varieties of qualities.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

12. Internal assessment of the practical/laboratory work requires teachers to think about assessment in terms of educational and assessment objectives.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

13. Internal assessment of the practical/laboratory work enables students to be assessed on how they undertake practical work as well as on its outcomes.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

14. Internal assessment in the practical/laboratory work is likely to be more objective than external assessment.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

15. Internal assessment in the practical/laboratory work can some times endanger the relationship between teacher and student.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

16. Internal assessment in the practical/laboratory/field work makes it difficult to relate and compare standards between institutions/colleges.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

17. Internal assessment in the practical/laboratory/field work can give rise to suspicions in the minds of users about the validity and reliability of the results of the assessment.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

E. Design of Practical/Laboratory/Field work

Below is given a list of items regarding the design of assessment procedure for practical/laboratory/field work. You have to respond to all the items accordingly.

1. There is a need to restructure our practical/laboratory/field work. There are many ways to do this. One way is to have both varification experiments (these remain the same year after year and batches after batches), investigation experiments in various areas. Verification experiments/practical/field work try to develop skills and abilities to verify the correctness of theory taught already, explore limitations etc. While investigation experiments certainly develop skills and abilities to solve a practical problem systematically without necessarily having to know the theory behind. Do you subscribe to this?

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

2. Very often laboratory/practical/field work is planned on the basis of a 'cycle' once or twice in a week. A group of students is asked to do an experiment/practical/field work and mostly one of them will do and others make use of his work. This happens more in verification experiment/practical field work.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

3. Investigation experiment/practical/field work can be planned on a series of questions systematically designed to get answered by students (very often working individually). By the time, the student comes to the end, he would have performed a practical/ an experiment/ a field work and will have the thrill of having 'discovered' the theory behind. This type of 'discovery'

learning is retained for long and is also capable of being applied else where etc.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

Investigation experiments and practical work involving handling of instruments can also be designed in the form of Programmed instruction materials. This is a form in which, the student working individually and at his own pace, encounters written material in the form of 'frames' together with questions to be answered by him. As soon as an answer is provided by him, he will have to turn to the next frame where the 'correct answer' will be given. A series of steps involved in handling instruments can be 'programmed'. During the practical/laboratory/field work examination the knowledge of the various abilities of the students can be assessed by the following techniques:

4. The assessment of the knowledge regarding the apparatus could be undertaken by presenting the student with pieces of apparatus and requiring him to name them and to describe their use.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

5. The assessment of knowledge regarding the procedures of the practical/laboratory/field work could be undertaken by using objective items.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

6. The assessment of knowledge regarding the ways of using apparatus in the practical/laboratory/field work could be undertaken by asking the students to perform certain operations with the apparatus.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

7. The assessment of the ability to use apparatus could be undertaken by means of simple exercises involving the use of a particular piece of apparatus.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

8. The assessment of the ability to implement procedures could be undertaken by providing simple instructions for the particular procedures and requiring the student to perform it.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

9. The assessment of the ability to select appropriate procedures for a particular practical problem could be undertaken by presenting the student with a practical problem and a range of alternative apparatus and procedures.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

10. The assessment of the ability to observe the material under investigation could be undertaken by requiring the student to translate his observations into oral or written terms.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

11. The assessment of the ability to observe changes or differences taking place in the material under investigation could be undertaken by presenting the student with a practical situation and requiring him to observe the changes which take place and to identify and isolate the changing factors in such a way that they can be studied more comprehensively.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

12. The assessment of the ability to record appropriately observed material and the changes which take place in it could be undertaken by evaluating the use made by the student of the available methods of recording observations.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

13. The assessment of the ability to devise new apparatus/techniques to meet the demands of a particular problem could be undertaken by providing the student in a situation in which the apparatus and techniques used and the problems posed are sufficiently within his experience for him to appreciate that the former are insufficient to solve the latter.

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

14. The assessment of the ability to plan and carry out a practical investigation could be undertaken by presenting the student with a problem and requiring him to plan an appropriate practical procedure to solve it.

/______/	/______/	/______/	/______/	/______/
Very much agree	Agree	Uncertain	Disagree	Very much disagree

15. It is felt however to improve the content validity of our end practical/laboratory/field work examination we may follow procedure some what like this. The various experiments in practical/laboratory/field work are to be listed as conte areas and abilities like knowledge/skill/abilities listed as ability dimension and a table of specifications prepared.

Table of specification

Abilities Content	Knowledge	Skill	Abilities	Total
A				
B				
C				
D				
E				

Practical/Laboratory/Field work examination paper will consist of question from A, B, C, D & E reflecting the weightages indicated in the table. This is the way to improve the content validity of the end examination.

/______/	/______/	/______/	/______/	/______/
Very much agree	Agree	Uncertain	Disagree	Very much disagree

16. To improve the reliability, a combination of continuous assessment and end examination can be thought of and also abilities/skills that are to be answered by both decided earlier.

The end examination will consist of either an objective type part or an oral part to take care of assessment of knowledge of units, limitations of instruments etc., and a few exercises to test skills and a few other to test abilities spread over the various content areas as set out in the table.

/______/	/______/	/______/	/______/	/______/
Very much agree	Agree	Uncertain	Disagree	Very much disagree

17. Below is given an individual assessment format for laboratory/practical/field work.

S. No.	Practical No.	General Approach 4	Technique 4	Accuracy 5	Inter Pretation 6	Conclusion & report 6	Total Grade 25
1.	I						
2.	II						

Do you agree with this format?

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

18. Indicate the number of Laboratory experiments/Field Work/Exercises/Practical work you propose to give

during a semester ☐

during an academic year ☐

19. Indicate your class size ☐

20. Indicate the way you would organise Laboratory/Field/Practical work.

Once in a week ☐

Once in a day ☐

Once in a fortnight ☐

21. Indicate the duration of Laboratory/Field/Practical work as given in 19.

hrs. ☐

22. Indicate as to how many of these would be

Individual ☐

Group ☐

If "Group", what is the optimum No. of students in a group?

☐

23. It is felt that traditional laboratory sheets giving aim procedure, results, conclusion and reports based on this tend to encourage copying from only one student who performs the work in the laboratory/field. In its place

increasing use of laboratory sheet involving questions (answers) on an individual basis or programmed instruction material for handling instruments (in performing experiments) must be made to really make laboratories a learning place. How do you feel about it?

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

24. It is also felt that laboratory/practical/field work in order to develop the kind of skills/abilities desired, must be made up of verification as well as investigation types of exercises/experiments. This really means that certain experiments can be performed by students in an investigation type without even knowing the theory behind. These investigation experiments are so carefully planned that students will be led to 'discover' as it were, certain things which are not since then taught to them. In addition there is another value in it; this kind of investigation develops certain abilities/skills of experimentation, innovation, discovery that there is overall satisfaction leading to better motivation on the part of students. How do you feel about it?

☐ Very much agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Very much disagree

25. Do you feel that you can design "investigation" type of experiments yourself?

☐ Yes ☐ No

If 'No' do you need help in this regard?

☐ Yes ☐ No

26. Do you consider that extra preparation and time are required on your part?

☐ Yes ☐ No

27. Do you agree with the format?

☐ Yes ☐ No

F. Marking Versus Grading for Practical/Laboratory/Field Work

Below is given a list of items regarding marking versus grading system for practical/laboratory/field work. You have to respond to all the items accordingly.

1. The numerical marking system provides a very inaccurate measurement of academic achievement. The marking system does not use the full range of marks 0 to 100 everywhere. A range of 20 to 55 is very common in History, Commerce or Psychology etc. The highest mark obtained by an outstanding student in Mathematics is nearly 100; an equally outstanding student of History gets somewhere say 58 which is not a first class mark since very often 60% and above is our arbitrary first class. So it happens that in certain subjects students can't get a first class however outstanding their performance may be.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

2. Very often it happens that one examiner marks his papers from a high mark of 80 to a low mark of 30 while another marks his from 60 to 20 such a difference is quite common in the numerical marking system and it is unfair to students. The unfairness would be eliminated if the marks were scaled to a common standard. The difference between one examiner's 80 and the other's 60 would then become immaterial. They would agree in this that these are the best papers and that is exactly what we need to know. The function of marks is to determine the rank order of the students. This therefore is the fucntion of the examiner, this and no other.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

3. If we adopt a sound grading system in the place of marks, most of the things mentioned above are taken care of.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

4. The present marking system is very simple, so simple that the marks of examiners are used for comparison when they are not comparable: they are not scaled, which they should be; raw scores in different subjects are added, which they should not be. This indeed is simplicity at the expense of all other standards.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

5. It is easily appreciated that if all Indian Universities adopt the same grading system and interpret in the same way, then students can easily move from one university to another within a state or from one state to another. This is

advisable and also desirable from the point of view of national integration.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

6. Especially in essay type examinations, the error of measurement in terms of marks renders it difficult to make fine distinctions. A range of marks has better meaning than individual marks. If even after scaling, an appreciable amount of error still remains, only grading can solve the problem.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

7. Under the system of grading there is the definite chance of getting an O, the outstanding performance, whatever the discipline. The choice of disciplines and subjects by students will be more likely to happen with their aptitude & ability.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

8. In Practical/Laboratory/Field work, there are Heads of assessment for every experiment/exercise. These are (as detailed out earlier) General approach, Technique, Accuracy, Interpretation & Conclusion and Report. These lend themselves to Grading rather than marking.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

9. The Grading System recommended is the 7 point scale

O	Outstanding
A	Very good
B	Good
C	Average
D	Below Average
E	Poor
F	Very poor

It is also recommended that 'Direct Grading' can be resorted to in assessing Practical/Laboratory/Field work.

☐	☐	☐	☐	☐
Very much agree	Agree	Uncertain	Disagree	Very much disagree

10. **Assuming the format for assessment as given earlier**

S. No.	Description of Practical/Lab. / Field work	Gen. Approach	Technique	Accuracy	Interpretation	Conclusion & Report	OVER ALL GRADE WEIGHTS GPA.
		4	4	5	6	6	
1		A	A	O	A	B	

and supposing a student is directly graded as A in General approach A in Technique, O in Accuracy, A in Interpretation and B in Conclusion & Report then the overall Grade for this experiment/exercise is worked out as follows.

	Weight	Grade	Weight Grade	Remark	
General Approach	4	A	24	O	7
Technique	4	A	24	A	6
Accuracy	5	O	35	B	5
Interpretation	6	A	30	C	4
Conclusion & Report	6	B	30	D	3
			143	E	2
				F	1

Overall Grade $= \frac{143}{25} = 5.72$ A (5.72)

Do you think you can do this for all experiments/exercises for all students?

☐ Very much agree

☐ Agree

☐ Uncertain

☐ Disagree

☐ Very much disagree

11. Attitude to Practical/Laboratory/Field work:

Attitude measuring scales are to be constructed and grading on a 5 point scale can be done. Here continuous internal assessment by the teacher making use of an attitudinal scale is much more meaningful and valid.

S. No.	Description	5	4	3	2	1
1.	Admires good students, teachers of the subject & literature					
2	Is ready to undertake practical work ?					
3.	Is ready to undertake test ?					
4.	Examines every detail in the practical/laboratory problems.					
5.	Seeks fresh clues beyond the ones known.					
6.	Reports observations without working up (cooking)					
7.	Accepts mistakes without reservation.					
8.	Is ready to experiment again ?					
9.	Sticks to the practical/laboratory/field problem and never leaves it unsolved.					
10.	Takes pleasure in doing practical/laboratory/field work.					

Do you think that this is possible at least 2 or 3 times in a semester/or in a year for all students ?

☐ Very much agree

☐ Agree

☐ Uncertain

☐ Disagree

☐ Very much disagree